
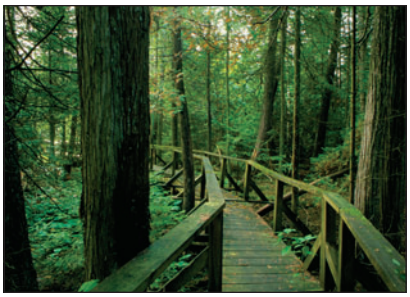

HUMBER RIVER WATERSHED PLAN

PATHWAYS TO A HEALTHY HUMBER

JUNE 2008

Prepared by:
Toronto and Region Conservation

Humber River

Toronto and Region Conservation for The Living City

2008

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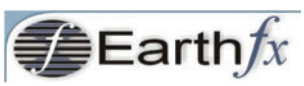
ACKNOWLEDGEMENTS

This Humber River Watershed Plan—*Pathways to a Healthy Humber*—was written by Suzanne Barrett, edited by Dean Young and represents the combined effort of many participants. Appreciation and thanks are extended to Toronto and Region Conservation staff and consultants (listed in Appendix F) for their technical support and input, to government partners for their financial support and input, and to Humber Watershed Alliance members for their advice and input.



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HUMBER RIVER WATERSHED PLAN
PATHWAYS TO A HEALTHY HUMBER

EXECUTIVE SUMMARY

The Humber River watershed is an extraordinary resource. It spans 903 square kilometres, from the headwaters on the Niagara Escarpment and Oak Ridges Moraine down through fertile clay plains to the marshes and river mouth on Lake Ontario. The watershed provides many benefits to the people who live in it. It is a source of drinking water drawn from wells or from Lake Ontario. Unpaved land absorbs water from rain and snowfall to replenish groundwater and streams and reduce the negative impacts of flooding and erosion. Healthy aquatic and terrestrial habitats support diverse communities of plants and animals. Agricultural lands provide local sources of food and green spaces provide recreation opportunities. A rich human heritage affords links to the past that enrich and inform our lives today. The natural beauty of the forests, meadows, farmlands, wetlands, rivers and creeks provides urban dwellers with solace, renewal and contact with nature.

However, this magnificent resource is under stress from human activities. The Humber Watershed Alliance, formed in 1994 to co-ordinate and promote activities to improve watershed health, gave the watershed an overall C grade in *Listen to Your River: A Report Card on the Health of the Humber River Watershed, 2007*. This grade was based on an average of the results for 26 indicators of watershed health that illustrate a wide range of conditions, from a very good rating for the protection of significant landforms to a failing grade for stormwater management. Conditions also vary considerably in different parts of the watershed, with generally higher grades in the upper, more rural parts of the watershed and lower grades in the highly urbanized lower portions. This review of watershed health emphasizes the need to continue working to protect what is valuable and restore what is degraded.

Issues identified in the report card include many harmful effects of urbanization on water balance, water quality, natural cover, aquatic and terrestrial communities, cultural heritage and air quality. These effects include increased surface runoff, more water pollution, greater annual flow volumes in rivers and streams, increased erosion and sedimentation, channel instability, smog, and losses of cultural heritage and biodiversity. All upland forest connections have been severed in the City of Toronto, City of Brampton and the southern portions of both the City of Vaughan and the Town of Caledon, and more natural vegetation is scheduled for removal, according to current urban development plans. Only 25 per cent of the urban area in the watershed has some level of stormwater management. The quality of fish habitat is deteriorating in many of the watershed's streams.

Successes include the 1999 designation of the Humber as a Canadian Heritage River. This designation recognizes the Humber River's contribution to the development of the country and its importance in the history of First Nations peoples and the early Euro-Canadian explorers and settlers of Upper Canada. Provincial initiatives, including the *Niagara Escarpment Act, the Oak Ridges Moraine Conservation Act*, the *Greenbelt Act*, the *Places to Grow Act*, the *2005 Ontario Provincial Policy Statement*, the *Ontario Heritage Act* and the recently adopted *Ontario Regulation 166/06* for conservation authorities, provide increased protection for landforms, environmental and cultural resources, and agricultural lands. In addition, many protection, stewardship and regeneration projects have been implemented. Over 400,000 trees and shrubs were planted and 8.8 hectares of new wetlands were created in the watershed between 2001 and

2006. The removal of in-stream barriers is allowing rainbow trout, brown trout and salmon to access spawning grounds in the Humber River. The recent creation of the Oak Ridges Corridor Park in Richmond Hill is protecting 428 hectares of land from development and retaining the last remaining natural linkage between the western and eastern parts of the Oak Ridges Moraine.

The Humber watershed will experience further, major changes in land use over the next few decades. Approved official plans allow for an additional 8,845 hectares of new urban lands beyond 2002 land uses, increasing the amount of the watershed that is urbanized from 27 per cent to 36 per cent. Once these plans are implemented, there will probably be further development in some watershed municipalities up to the boundaries of the Greenbelt Plan and Oak Ridges Moraine Conservation Plan. A large amount of commercial development is projected to occur along the east branches of the West Humber (the City of Brampton and the Town of Caledon) and in the Rainbow Creek and Purpleville Creek subwatersheds (the City of Vaughan). The proposed expansion of the 400 series of provincial highways includes an anticipated extension to Highway 427 through the central part of the watershed. Trends in municipal servicing may result in a shift from groundwater supplies to lake-based water supplies, for example, in the Village of Kleinburg and the Village of King City.

The population size and diversity of the Humber watershed continues to expand. In 2001 (based on census data) there were approximately 670,000 people living in the watershed, an increase of 37 per cent from 1995. Much of this population growth, and associated urban development, has occurred within the City of Vaughan, the Town of Richmond Hill and the City of Brampton. The growing population and cultural diversity of the watershed may create demands for different types of nature-based recreation and cultural heritage interpretation activities as well as new approaches to community involvement in stewardship and education programs.

What is the role of the watershed plan? The watershed plan is intended to inform and guide municipalities, provincial and federal governments, Toronto and Region Conservation (TRCA), non-governmental organizations and private landowners as they update their policies and practices for environmental protection and stewardship.

This updated watershed plan is part of an adaptive management approach to address these challenges. Since the publication of Legacy: A Strategy for a Healthy Humber in 1997, much has been learned about the Humber watershed from monitoring, research and the experiences of watershed partners. This plan updates the watershed management strategies in Legacy in light of new information, a stronger scientific foundation and better understanding of the effects of human actions on the ecosystem. There is also a need to respond to a number of recent policy and planning initiatives, including the Oak Ridges Moraine Conservation Plan, Growth Plan for the Greater Golden Horseshoe, Clean Water Act, the City of Toronto's Wet Weather Flow Management Master Plan, stormwater retrofit studies of other municipalities and TRCA's vision for The Living City.

The guiding framework for this watershed plan is a set of principles and 30 objectives with specific targets for watershed conditions. They address

- **Environment:** stream form, groundwater, surface water, air, aquatic system, terrestrial system
- **Society:** cultural heritage, nature-based recreation
- **Economy:** land use, resource use

Nine potential future scenarios were developed and examined in relation to existing conditions to provide an understanding of how the watershed might react to changes in land use and environmental management in the future. This process revealed that, if future development proceeds with current approaches to community design and stormwater management, it will not be possible to maintain current conditions, let alone improve them. Instead, there will be additional deterioration of environmental conditions and biodiversity, and damage to infrastructure and property. Further, the analysis showed that even if the most innovative, sustainable community measures are applied, this deterioration cannot be completely prevented throughout the watershed. The anticipated effects of climate change may exacerbate these concerns.

The path to a healthier, more resilient watershed that emerged from this analysis is based on a comprehensive and interdependent set of strategies that will protect and enhance valued resources, regenerate damaged systems and build more sustainable communities. This will help to increase the resilience of natural systems to human activities and climate change. It will also create healthier places for people and wildlife, and stronger support for economic activities.

The recommended management strategies fall into three broad categories:

1) **Protect and expand the terrestrial natural heritage system.** Figure 5.2 illustrates an expanded natural heritage system that provides multiple benefits, including biodiversity and habitats, water balance maintenance and restoration, opportunities for nature-based recreation, carbon sequestration, improved quality of life and greater resilience to urban growth and climate change. This system can be accomplished by protecting existing valued assets, securing additional lands, regenerating degraded areas and improving stewardship of public and private lands. The first priority is the land in the potential greenfield development areas outside the Niagara Escarpment and the Oak Ridges Moraine and Greenbelt. The second priority is the protected countryside areas of the *Greenbelt and Oak Ridges Moraine Conservation Plans* and the rural area of the *Niagara Escarpment Plan*. The third priority is in natural core and linkage areas of the *Oak Ridges Moraine Conservation Plan* and natural areas of the *Niagara Escarpment Plan*.

2) **Build sustainable communities.** More sustainable approaches to urban form, infrastructure, transportation and resource use are proposed in order to contribute to increased environmental integrity and quality of life. They should be applied to new communities, as well as to the intensification or redevelopment of existing ones. Some of the key features include reduced imperviousness, rainwater harvesting and other measures to maintain or restore predevelopment water balance, design features to facilitate sustainable choices (e.g., energy conservation, reduced vehicle use, support for local agricultural products) and protection and adaptive reuse of cultural heritage features. Erosion and sediment control practices must be improved to protect watercourses, especially in areas of intense urban growth. Development should be designed to proceed at a pace and extent that allows sufficient time to adopt, test and evaluate the effectiveness of new technologies and to make adjustments if the results do not meet the objectives and targets for the watershed.

3) **Recognize the distinctive heritage of the Humber through an enhanced regional open space system.** The Humber watershed has the basis for a significant, linked, regional open space system including inter-regional trails, conservation areas, major municipal parks, and cultural heritage features and landscapes. Greater collaboration is needed between public and private sector partners to improve links between nature-based recreation

and cultural heritage destinations and experiences and to facilitate better planning and management of the system. This system should be further developed for its potential to provide experiences for a growing population, support for healthy communities, interpretation of natural and cultural heritage, links with local neighbourhoods and connections to surrounding watersheds and regions. The status of the Humber as a Canadian Heritage River is a remarkable designation that should be promoted. Completion of a contemporary trail along the historic Carrying Place portage route that follows a spectacular river valley system would help to highlight and connect people with the natural and cultural heritage assets of the watershed.

A collaborative, integrated approach is required to accomplish the management strategies. This begins with increased awareness to ensure that watershed residents, businesses, developers and agencies understand the importance of the watershed, its water cycle, natural systems and cultural heritage. The co-ordinated efforts of government agencies and community leaders must be applied to plans and policies, permits and regulations, enforcement, infrastructure operations and maintenance, stewardship and regeneration programs, and education and awareness initiatives.

A healthy, sustainable Humber watershed is within reach, although many challenges lie ahead. This plan shows that a "business-as-usual" approach to future development will result in continued losses of environmental quality, biodiversity and cultural heritage. There will be considerable costs to address the health, social and economic consequences of degraded environmental conditions, and damaged infrastructure and property. Instead, there are opportunities to create a better future, with healthy natural systems and a rich natural and cultural heritage, supporting a high quality of life for our communities. With the guidance offered in this plan, a concerted effort by all watershed partners can bring these opportunities to fruition.

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A view of the Humber River, a living legacy.
Photography by Jeff Hladun

CHAPTER

1

1.0 INTRODUCTION

The Humber River watershed is a legacy, a priceless endowment to the people of the Greater Toronto area. The river starts 126 kilometres from Lake Ontario in the ancient rock of the Niagara Escarpment and the rolling hills of the Oak Ridges Moraine. Here, rainwater percolates through the rock, sands and gravels, and collects in wetlands and small streams to start its southward journey. Hundreds of creeks and streams intertwine and join to form larger tributaries that, in turn, become the river that flows into Lake Ontario.

The bounty of the Humber watershed is multi-faceted. It is geological, natural, historical, recreational and economic. The geological legacy is inherited from the Wisconsin glaciers of the last ice age. They sculpted hills and valleys, deposited the sand and gravel that formed the Oak Ridges Moraine and left the fertile soils that carpet the Peel Plain. The rich natural inheritance of the watershed includes the river system itself, Carolinian and Great Lakes-St. Lawrence forests, wetlands and marshes, rare kettle lakes, abundant groundwater, grasslands and meadows, and varied wildlife.

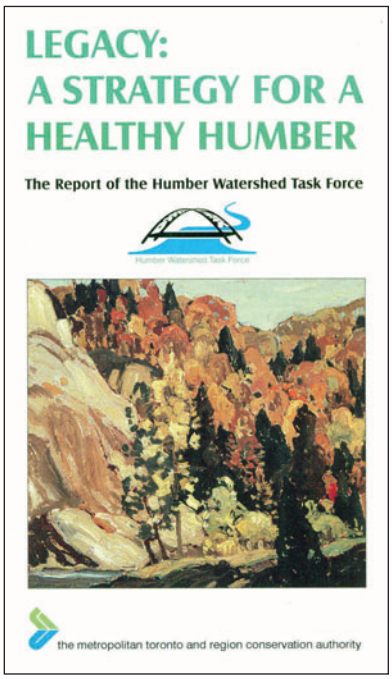
These natural resources were the basis for the early aboriginal livelihood in the watershed, trade with European explorers, the Carrying Place Trail, and later for the growth of European farms and settlements. Throughout the watershed we find links to the past—sites that contain archaeological remains from First Nations peoples and early settlers, as well as heritage houses, farms, mills and other buildings that were constructed within the last 200 years.

As immigration to the Greater Toronto Area (GTA) continues, watershed communities are becoming increasingly multi-cultural, bringing together people from diverse backgrounds. Economic activities in the Humber watershed provide prosperity and a high standard of living to most of its inhabitants and include agriculture, industry, commerce, health care, cultural activities and sports. The watershed has an extensive system of linked greenspace that provides exceptional and varied recreational opportunities.

The Humber watershed is the largest watershed in the Toronto and Region Conservation (TRCA) jurisdiction, spanning 903 square kilometres (90,300 hectares). It includes portions of 10 local municipalities: the City of Vaughan, the Town of Richmond Hill, the Township of King and the Town of Aurora in the Regional Municipality of York; the Cities of Brampton and the City of Mississauga and the Town of Caledon in the Regional Municipality of Peel; the City of Toronto;

the Town of Mono in Dufferin County; and the Township of Adjala-Tosorontio in Simcoe County (Figure 1–1 and Figure 1–2).

A multi-stakeholder Humber Watershed Task Force was established in 1994 to develop an ecosystem-based strategy to achieve a sustainable, healthy watershed for the Humber River. In 1997 the Task Force published *Legacy: A Strategy for a Healthy Humber* and *A Call to Action*. These documents emphasize that, although the Humber watershed represents a wonderful natural inheritance, it should not be taken for granted. They provided 30 objectives for a healthy, liveable, sustainable and prosperous watershed and recommended actions to achieve them. These included measures to celebrate what is outstanding, protect what is healthy and regenerate what is degraded. Toronto Region Conservation established the Humber Watershed Alliance in 1997 with a mandate to oversee implementation of Legacy. In 2000 and 2007, the Alliance published report cards summarizing and evaluating watershed conditions. In 2003, a progress report was issued to highlight efforts to protect and restore the watershed by the Alliance and many other watershed partners.



Since 1997, the Alliance has recorded both successes and failures on the path to a sustainable, healthy future for the Humber watershed. One of the major successes was the 1999 designation of the Humber as a Canadian Heritage River, recognizing its contribution to the development of the country as well as its importance in the history of First Nations peoples, the early Euro-Canadian explorers and settlers of Upper Canada. This designation helps to conserve and protect the best examples of Canada's river heritage, gives them national recognition and encourages the public to enjoy and appreciate rivers. Provincial initiatives including the Niagara Escarpment Act, the Oak Ridges Moraine Conservation Act, the Greenbelt Act, the Places to Grow Act, the 2005 Ontario Provincial Policy Statement, the Ontario Heritage Act and the recently adopted Ontario Regulation 166/06 for conservation authorities, all provide increased protection for landforms, environmental and cultural resources, and agricultural lands.

Figure 1–1: Municipal share of the Humber River watershed (% total area)

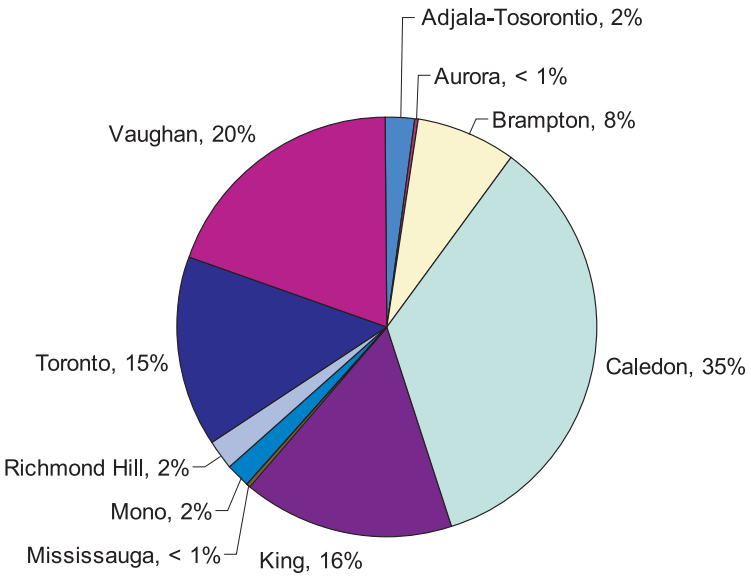
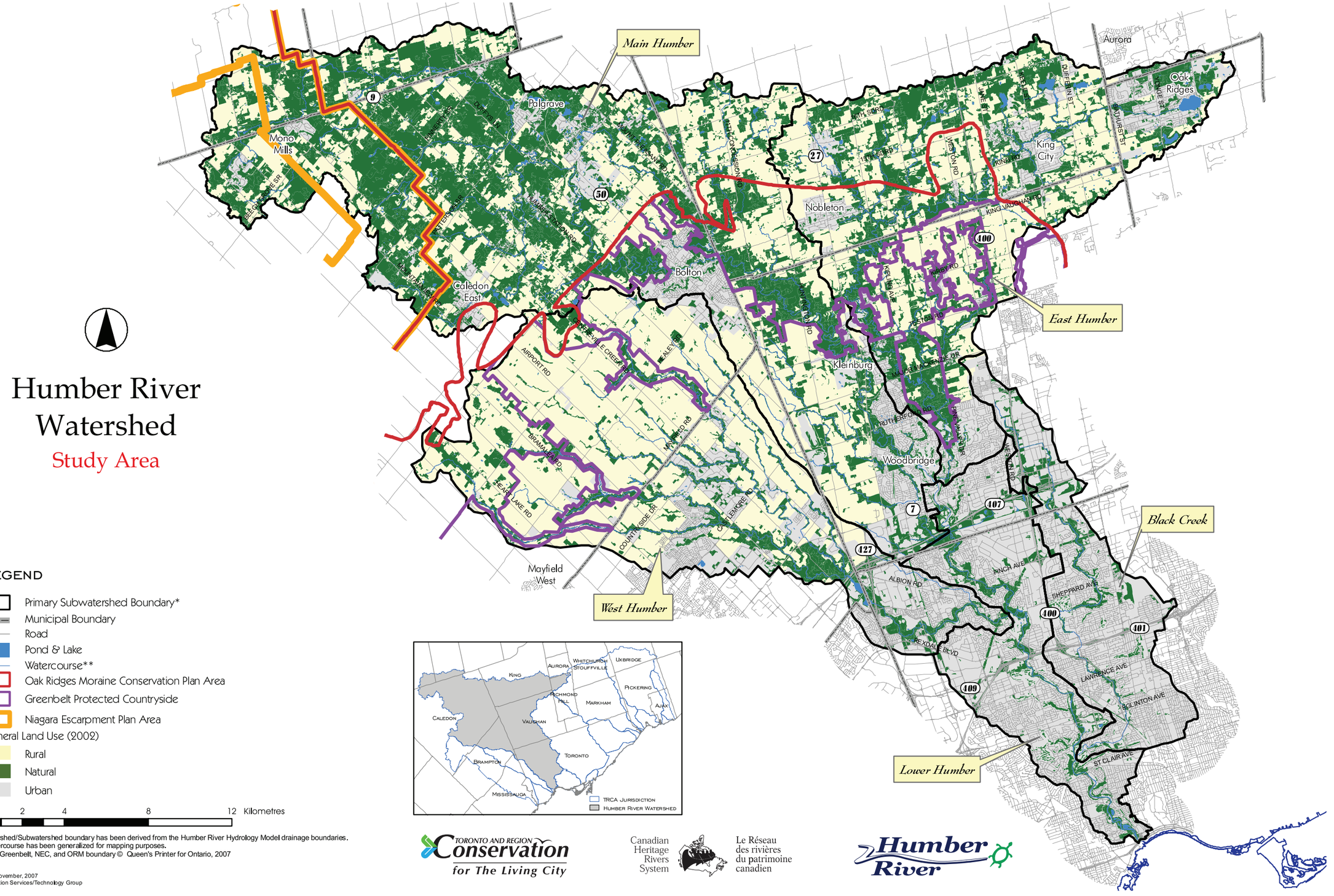


Figure 1–2: Study area



Numerous protection, stewardship and regeneration projects have been undertaken. For example, over 400,000 trees and shrubs were planted and 8.8 hectares of new wetlands were created in the watershed between 2001 and 2006. The removal of in-stream barriers is allowing rainbow trout, brown trout and salmon to access spawning grounds in the Humber River. The recent creation of the Oak Ridges Corridor Park in Richmond Hill is protecting 428 hectares of land from development and retaining the last remaining natural linkage between the western and eastern parts of the Oak Ridges Moraine. The length of completed trails in the watershed has increased by 28 kilometres between 2000 and 2006.

Examples of failures include urban development that has severed all upland forest connections in the cities of Toronto and Brampton and the southern portions of both the City of Vaughan and the Town of Caledon. More natural vegetation may be removed according to current urban development plans. Only 25 per cent of the urban area in the watershed has some level of stormwater management. The quality of fish habitat is deteriorating in many of the watershed's rivers and streams. Public awareness of watershed issues has declined, with only 32 per cent of respondents to a recent opinion poll being aware that water from storm drains goes untreated into the Humber River (Pollara, 2006). Clearly, there is still much work to be done to achieve the vision of a healthy, sustainable and prosperous watershed.

1.1 WHY DO WE NEED THIS UPDATED WATERSHED PLAN?

If you live, work or play in the Humber watershed, you depend on its health. The Humber watershed is a source of your drinking water, whether you rely on wells or water from Lake Ontario. Unpaved land absorbs water from rain and snowfall to replenish groundwater and streams and reduce the negative impacts of flooding and erosion. Healthy aquatic and terrestrial habitats support diverse communities of plants and animals. Agricultural lands provide local sources of food and public greenspace provides recreation opportunities. A rich cultural heritage affords links to the past that enrich and inform our lives today. The natural beauty of forests, meadows, farmlands, wetlands, rivers and creeks provides urban dwellers with solace, renewal and contact with nature.

During the past 10 years, much has been learned about the Humber watershed from monitoring, research and the experiences of watershed partners. It is now time to update the watershed management strategies in light of new information, a stronger scientific foundation and better understanding of the effects of human actions on the ecosystem.

Specifically, the watershed plan is intended to inform and guide municipalities, provincial and federal governments, TRCA, non-governmental organizations and private landowners as they update their policies and practices for environmental protection and stewardship.

For example, the *Oak Ridges Moraine Conservation Plan* (OMMAH, 2002) requires municipalities to incorporate the objectives and requirements of watershed plans into their official plans. The *Clean Water Act*, 2006 calls for watershed-based planning to protect sources of drinking water. Information in this watershed plan will be used as input to source protection plans and supporting reports. The watershed plan will also help to guide municipalities as they undertake their growth planning exercises in response to the provincial *Growth Plan for the Greater Golden Horseshoe* (OMPIR, 2006), which targets additional population growth beyond the current levels of the official plans.

In 1987, the Toronto Region was included in a list of 42 areas of concern around the Great Lakes. The Toronto and Region Remedial Action Plan (RAP) *Clean Waters, Clear Choices* (1994) recommended a watershed-based approach to de-listing impaired beneficial uses of the City of Toronto waterfront and watersheds. This *Humber River Watershed Plan* provides strategic recommendations regarding high-priority remedial actions, such as priority areas for improvement of stormwater management controls and habitat restoration.

Watershed municipalities and other stakeholders have identified a number of issues and opportunities that they would like to see addressed by the watershed plan. The City of Toronto's *Wet Weather Flow Management Master Plan* (XCG, 2003) identified a specific need to undertake restoration to mitigate impacts of development in upstream municipalities and to complement actions being taken in the City of Toronto. Many of the municipalities upstream of the City of Toronto have prepared stormwater retrofit studies that help to address this need and are beginning to implement them. New information and analysis about the impacts of development and potential future scenarios will help to provide a context to guide these activities. Stakeholders also want to identify specific stewardship and regeneration priorities in the context of TRCA's *Toronto and Region Terrestrial Natural Heritage System Strategy* (TRCA, 2007b). Other concerns include the sustainability of agriculture in this urbanizing region, inadequate erosion and sediment control practices during construction, and the need for effective ways to deal with operations and maintenance issues such as municipal open space lands, winter road maintenance and stormwater facilities.

Finally, this plan contributes to TRCA's vision for The Living City which states:

> *The quality of life on Earth is being determined in the rapidly expanding city regions. Our vision is for a new kind of community, The Living City, where human settlement can flourish forever as part of nature's beauty and diversity. The objectives of The Living City are:*
>
> - *Healthy rivers and shorelines*
> - *Regional biodiversity*
> - *Sustainable communities*
> - *Business excellence*

PLAN DOCUMENTS

This plan is only the tip of an iceberg. It synthesizes and is supported by a number of documents including:

- State of the Watershed Reports
- Scenario Modelling and Analysis Report
- Implementation Guide
- Other technical documents

To access these resources, visit **www.trca.on.ca**

1.2 HOW WAS THE PLAN PREPARED?

This plan was prepared by TRCA staff and consultants, with advice from the Humber Watershed Alliance, which has representation from all levels of government agencies, private businesses, not-for-profit organizations and the public, and is co-ordinated by TRCA.

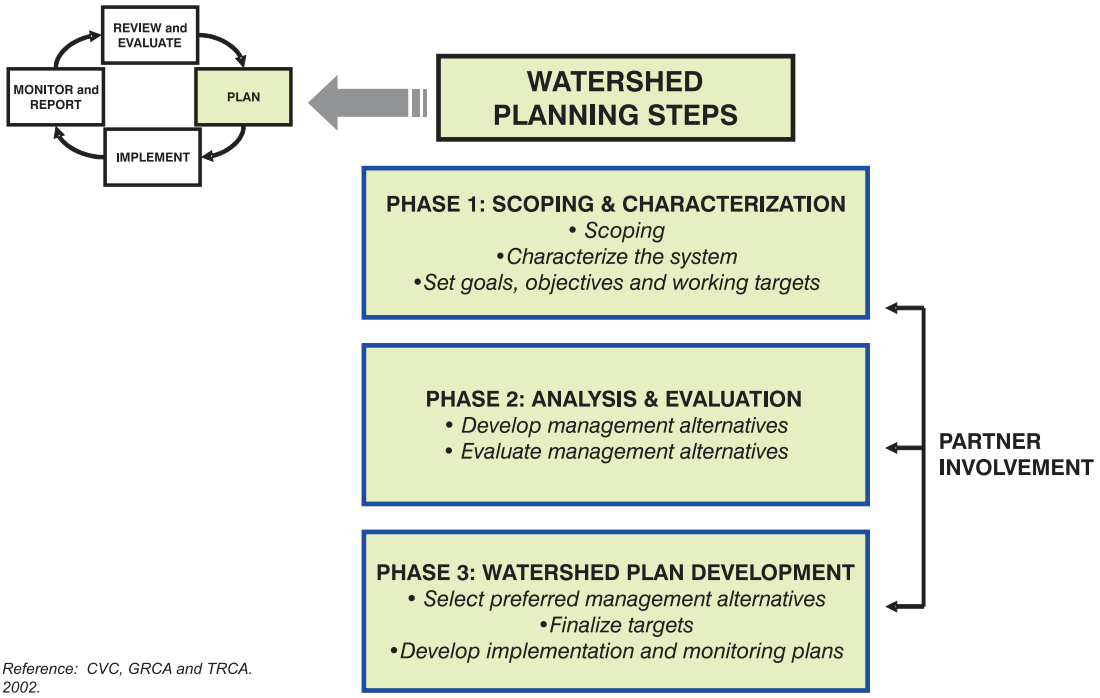
This plan updates *Legacy: A Strategy For A Healthy Humber* (MTRCA, 1997) by building on existing information and addressing identified data gaps, particularly with respect to the groundwater system, water budget, water use and terrestrial natural heritage system. The 2007 Humber watershed report card, *Listen to Your River* (TRCA, 2007a), contributed an up-to-date synthesis of current conditions and progress toward meeting targets and initiatives that are underway. The plan has a strong technical foundation, based on several years of monitoring environmental conditions combined with a leading edge approach to modelling of potential future conditions. A series of management summits was held to convene experts who could help

identify best practices and recommendations to achieve watershed objectives. Meetings were held with agencies, other watershed partners and the public to review issues and seek feedback on the plan's recommendations.

Approaches to watershed planning have evolved during the 10 years since *Legacy* was published. It is now possible to take a more integrated approach that focuses on interdependencies among watershed systems and evaluates proposed actions based on their ability to achieve multiple and synergistic benefits.

Figure 1–3 illustrates how the watershed planning process is part of a continuous cycle of adaptive watershed management, whereby a plan is prepared and implemented, progress is monitored and the plan is updated. The Humber watershed has benefited from one complete cycle of watershed planning and this plan represents the beginning of a second cycle. This demonstrates how the plan is a living document that will continue to be revised in the future to reflect changing realities.

Figure 1–3: Watershed planning process



Reference: CVC, GRCA and TRCA. 2002.

1.3 WHAT'S IN THIS PLAN?

Chapter 2 presents the guiding principles and objectives for the Humber watershed that form the framework for the plan's strategies and targets. A review of current conditions in the Humber watershed in Chapter 3 provides a summary of updated information on geology and landform, water, aquatic and terrestrial communities, and human heritage and current activities. Key management issues are identified to guide the development of the plan's recommendations. In Chapter 4, possible futures under different land use and environmental management scenarios are considered. Chapter 5 contains management strategies and recommends actions to implement them. The conclusions of this plan outline the overall direction that watershed partners should pursue over the coming decade. The appendices include a table summarizing objectives, indicators and targets for watershed health, a list of reference materials, a glossary of terms and a summary of the scenarios examined.

A view of the Humber River.
Photography by Jon Clayton

1.4 LOOKING TO THE FUTURE

The 2007 Humber watershed report card prepared with the help of the Humber Watershed Alliance gave the watershed an overall grade of C, or fair, based on an average of the results for 26 indicators of watershed health. However, there are a wide range of conditions from a very good rating for the protection of significant landforms to a failing grade for stormwater management. Conditions also vary considerably in different parts of the watershed, with generally higher grades in the upper, more rural, parts of the watershed and lower grades in the highly-urbanized lower portions. This review of watershed health emphasized the need to continue working to protect what is valuable and restore what is degraded.

Against the backdrop of current conditions and issues, some significant changes are on the horizon that will affect future conditions. For example, a large amount of commercial development is projected to occur along the east branches of the West Humber (the City of Brampton and the Town of Caledon) and in the Rainbow Creek and Purpleville Creek subwatersheds (the City of Vaughan). The proposed expansion of the 400 series of provincial highways includes an anticipated extension to Highway 427 through the central part of the Humber watershed. Trends in municipal servicing may result in a shift from groundwater supplies to lake-based water supplies, for example, in the Village of Kleinburg and the Village of King City.

The population size and diversity of the Humber watershed continues to expand. In 2001 (based on census data), there were approximately 670,000 people living in the watershed, an increase of 37 per cent from 1995. Much of this population growth, and associated urban development, has occurred within the City of Vaughan, the Town of Richmond Hill and the City of Brampton. The growing population and cultural diversity of the watershed may create demand for different types of nature-based recreation or cultural heritage interpretation activities and new approaches to community involvement in stewardship and outreach/education programs.

This plan addresses some key questions. What is the current state of health of the watershed? Will watershed health deteriorate as new development continues? Will it be possible to maintain existing conditions? Can watershed health be improved? And, if so, what are the priority actions that need to be taken?

CHAPTER

2

2.0 GUIDING FRAMEWORK

THE HUMBER CHALLENGE

Our challenge is to protect and enhance the Humber River watershed as a vital and healthy ecosystem where we live, work and play in harmony with the natural environment.

To help meet this challenge, the Humber Watershed Task Force developed a set of guiding principles and 30 objectives. They were first published in *Legacy: A Strategy for a Healthy Humber* (MTRCA, 1997), and some minor re-ordering and updates were undertaken for this plan, to reflect current approaches to management strategies.

2.1 PRINCIPLES

In order to achieve a healthy and sustainable watershed, it is necessary to

- Increase awareness of the watershed's resources
- Protect the Humber River watershed as a continuing source of clean water
- Celebrate, regenerate and preserve our natural, historical and cultural heritage
- Increase community stewardship and take individual responsibility for the health of the Humber River
- Establish linkages and promote partnerships among communities
- Build a strong watershed economy based on ecological health
- Promote the watershed as a destination of choice for recreation and tourism

2.2 OBJECTIVES

The objectives of this plan are grouped under three headings: Environment, Society and Economy. Associated with each objective are indicators and targets for watershed conditions (see Appendix A).

Photography by Jamie Duncan

Environment

Stream form

1. Protect the form and function of the Humber River and its tributaries

Groundwater

2. Protect groundwater recharge and discharge
3. Prevent groundwater contamination

Surface water

4. Protect and restore the natural variability of annual and seasonal stream flow
5. Maintain and restore natural levels of baseflow
6. Eliminate or minimize risks to human life and property due to flooding
7. Protect and restore surface water quality, with respect to toxic contaminants and other pollutants (such as sediment, nutrients, bacteria and road salt)
8. Manage stormwater to protect people and the health of streams and rivers

Air

9. Reduce air pollution to levels that protect human health, natural ecosystems and crops, and do not exacerbate global climate change

Aquatic system

10. Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species
11. Provide for sustainable fishing opportunities and the safe consumption of fish

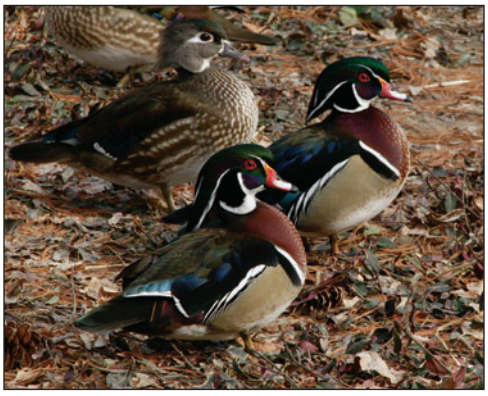
Terrestrial system

12. Protect, restore and enhance natural cover to improve connectivity, quality, biodiversity and ecological function
13. Minimize negative influences from surrounding land uses on terrestrial natural heritage system quality and function

East Humber at Humber Trails
Photography by Dean Young

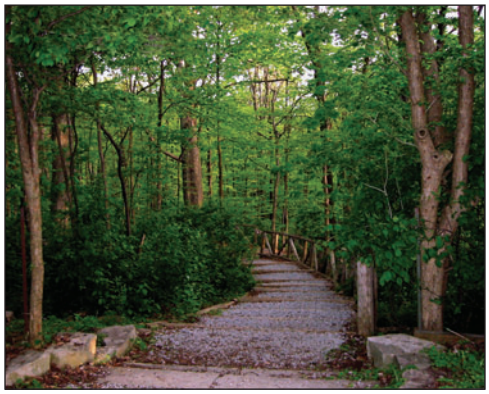
Stormwater management pond
Photography by Rose Hasner

Smog, City of Toronto



Wood ducks
Photography by Robert Lawton

Roblin's Mill at Black Creek Pioneer Village
Photography by Rose Hasner



West Humber Trail at the Humber Arboretum
Photography by Dean Young

Oak Ridges Moraine
Photography by Dean Young

Farm land
Photography by Dean Young

Society

Cultural heritage

14. Identify, document, protect and conserve cultural and heritage resources
15. Celebrate the diverse cultural and heritage resources of the Humber watershed
16. Identify and promote the economic value of cultural and heritage resources

Nature-based recreation

17. Incorporate greenspace in all urban and rural developments and create an accessible and connected greenspace system that is compatible with ecological and cultural integrity
18. Develop a system of inter-regional trails and local and regional nature-based recreation, education and tourism destinations within the greenspace system

Economy

Land use

19. Protect the form and function of landforms such as the Niagara Escarpment, Oak Ridges Moraine and South Slope
20. Balance economic development with protection of the environment and society
21. Improve sustainability in urban form at community and building site scales
22. Protect and enhance the integrity and economic viability of agricultural areas

Resource use

23. Practice sustainable resource use by individuals, households, businesses, institutions and governments
24. Use ground and surface water at sustainable rates

CHAPTER

3

3.0 CURRENT CONDITIONS AND ISSUES

3.1 WATERSHED PERSPECTIVE

A watershed is a complex system whose health depends on the proper functioning of all its parts, as shown in Figure 3–1. Climate and geology are its foundations, regulating the amount and distribution of both surface and ground water and the types of vegetation in the watershed. The amount of water and the rate at which it flows through the watershed affect the shape and size of creek and river channels and their associated flood plains. Different communities of plants and animals live where there are suitable aquatic and terrestrial habitats. While people depend on the resources of the watershed, their activities result in changes to all aspects of the system.

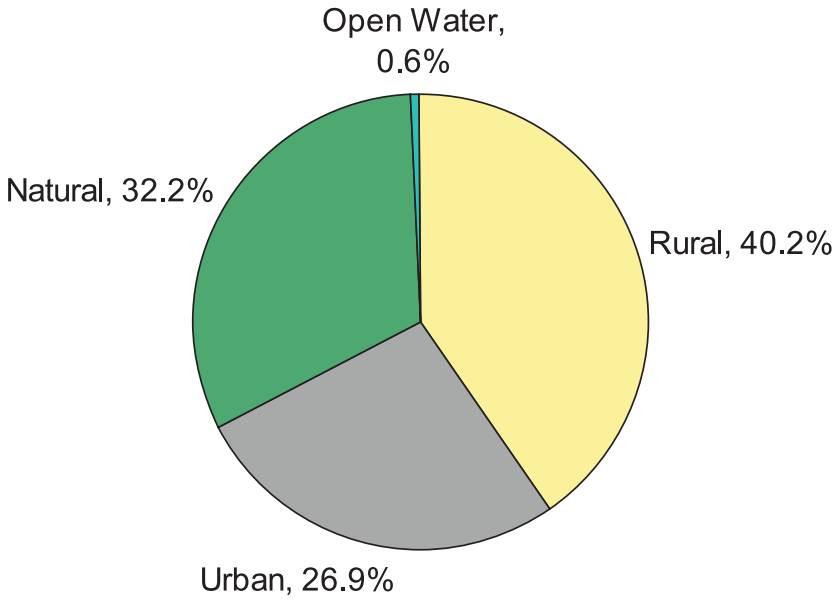
Figure 3–1: Watershed connections

For several millennia after the last ice age, vast tracts of forest, interspersed with wetlands and meadows, dominated the Humber watershed. First Nations people used the rich resources of the area, but major conversions of land did not begin until the arrival of European settlers in the late 18th century. They altered the original landscapes, clear-cutting forests for timber and farms, draining wetlands, installing dams for power and building settlements. Major shifts in

plant and animal communities followed. Over the last 50 years, much of the farmland and many rural settlements have been displaced by urban development, particularly in the southern and western portions of the watershed. Natural habitats have been further reduced and fragmented, hydrological patterns have changed, and additional species of plants and animals have disappeared from the watershed while others that thrive in disturbed areas have survived.

Approximately 27 per cent of the watershed is in urban land use, with 40 per cent in rural use and 32 per cent under natural cover (Figures 1–2 and 3–2). The greatest concentration of urban land use is in the southern portions of the watershed with urbanizing areas in the middle (north of Steeles Avenue) and predominantly agricultural lands, with villages and hamlets, in the north.

Figure 3–2: Humber River watershed general land use/land cover, 2002



The following descriptions of current conditions, relationships and issues in the Humber watershed are based primarily on environmental monitoring data up to 2002. They are provided in more detail in a series of State of the Watershed Reports (TRCA, 2008b-k) and summarized in Listen to Your River: A Report Card on the Health of the Humber River Watershed (TRCA, 2007a). They are presented in three sections: Environment, Society and Economy.

3.2 ENVIRONMENT

3.2.1 Climate

The Humber watershed, like other portions of southern Ontario, experiences a continental climate, moderated by the Great Lakes. The watershed is influenced by warm, moist air masses from the south and cold, dry masses from the north.

In an average year, precipitation in the Humber watershed typically ranges from 798 to 933 millimetres, depending on elevation and proximity to Lake Ontario. Mean annual evapotranspiration ranges from 517 millimetres per year in higher elevation areas, such as the Oak Ridges Moraine, to 469 millimetres along the Lake Ontario shoreline in the City of Toronto. The most precipitation occurs during the summer months (June, July and August).

Home flooded following Hurricane Hazel, the largest storm event on record in the watershed.

The largest storm on record in the watershed, Hurricane Hazel, occurred on October 15, 1954, with 121 millimetres of rainfall resulting in severe flooding, property damage and loss of life. The Oak Ridges Moraine (described below) influences precipitation in the northern portions of the watershed. When air masses moving inland from Lake Ontario reach the higher ground surfaces of the Moraine, they are forced to rise causing precipitation. Lake Ontario also influences local climate. For example, storms tracking along the Great Lakes can bring higher amounts of precipitation to the southern portions of the watershed. Lake Ontario can moderate temperatures as much as 10 kilometres inland, decreasing summer temperatures and increasing the number of frost free days. This allows for the growth of plant species, such as the Carolinian species present in the Humber watershed, that otherwise occur at lower latitudes.

Global climate change is likely to affect the Humber watershed, along with all the watersheds in this region. Although specific changes cannot be predicted at the watershed scale, it is expected that overall, the climate of southern Ontario will become warmer (several models predict increases between 5–10 °C by 2080). Predictions regarding precipitation are still uncertain, with some models showing increases from 6 to 20 per cent by 2080 and others predicting decreases. Different climate change models predict different distributions of these changes during the year. The weather is also expected to become more unpredictable, with greater variations and increases in extreme weather. The changes in climate may in turn result in a cascade of changes throughout the ecosystem, with effects on water balance, water availability, groundwater levels, stream flow, channel and stream bank stability, surface water quality, and terrestrial and aquatic habitats.

Key issues:

- Potential impacts of climate change on ecosystem characteristics and functions, public safety (flooding) and public health

Rolling hills or hummocky topography is a defining characteristic of the Oak Ridges Moraine area.
Photography by Dean Young

3.2.2 Geology and landform

2007 Report Card

- How well are significant landforms being protected?

Rating: A

Geology, landform, and soils significantly influence the processes responsible for water movement through the water cycle. The shape of the land, determined by geology and weather, greatly influences vegetation and drainage patterns. Soil types and structures are also dependent, in part, on the underlying geologic formations. For example, fine grained soils such as silt and clay limit infiltration and have higher surface runoff than sandy soils. Soil texture, structure, moisture holding capacity and local topography are also important factors determining the susceptibility of land to erosion.

In most of the Humber watershed, the bedrock comprises shale of the Georgian Bay Formation Shale. Limestone bedrock, which can store large amounts of groundwater, is restricted to the extreme upper reaches of the Main Humber subwatershed above the Niagara Escarpment. Extensive erosion of this bedrock surface took place over the span of millions of years, resulting in the formation of a deep bedrock valley system, known as the Laurentian Valley, extending from Georgian Bay to Lake Ontario. This valley was filled with up to 200 metres of sediments, and forms a series of interconnected aquifer and aquitard systems (Section 3.2.3).

The major physiographic regions in the watershed are shown in Figure 3–3 and include

- Niagara Escarpment (limestone ridge)
- Horseshoe Moraine (ridge of sand and gravel)
- Guelph Drumlin Field (rounded hills of stony glacial tills and gravel)
- Oak Ridges Moraine (ridge of sand and gravel)
- South Slope (gently sloping glacial till plain)
- Peel Plain (flat, silty clay, former lake bottom)
- Iroquois Sand Plain (sand, silt and clay deposits of former glacial Lake Iroquois)

3.2.3 Groundwater

Groundwater is vital to the healthy functioning of a watershed because it provides a constant source of clean, cold water to lakes and streams. In any given year it is estimated that about 55 per cent of stream flow in the Humber River and its tributaries comes from groundwater. Another important role of groundwater is water supply, with approximately 21,000 people in the watershed relying on municipal wells (Caledon East, Palgrave, the Village of Nobleton, the Village of King City and the Village of Kleinburg) and many rural residents relying on private wells.

Figure 3–4 illustrates the geological layers in the Humber watershed that comprise both water-bearing aquifers and non water-bearing aquitards, including:

- Recent Deposits (aquifer)
- Halton Aquitard
- Oak Ridges Aquifer
- Newmarket Aquitard
- Thorncliffe Aquifer
- Sunnybrook Aquitard
- Scarborough Aquifer
- Weathered Bedrock (aquifer)

2007 Report Card

- Is groundwater being used sustainably?

Rating: B

- How well is the quality of our groundwater being protected?

Rating: B

The major recharge areas within the Humber watershed occur in the northern portion, on the hummocky terrain of the Oak Ridges Moraine and on the Niagara Escarpment, where infiltration to surficial sand and gravel deposits may exceed 300 millimetres per year (Figure 3–5).

The direction of groundwater flow in the watershed's aquifers is generally from the Oak Ridges Moraine in the north to Lake Ontario in the south. In addition, significant flow occurs in all aquifers eastward from the Niagara Escarpment. The headwaters of the watershed generally function as a groundwater divide for the aquifers (Figure 3–5).

However, there are several areas where groundwater moves in or out of the Humber watershed. Where the Niagara Escarpment and Oak Ridges Moraine meet, there is uncertainty regarding groundwater divides and flow direction. It is known that there are significant inflows of groundwater from the Credit River watershed to aquifers in the northwestern part of the Humber watershed, in the vicinity of Caledon East and Bolton, due to the influence of a meltwater or tunnel channel and bedrock valley aquifer system. In the vicinity of the Village of Nobleton there is some inter-basin flow of groundwater from the Holland River watershed into the Humber, and in the vicinity of Palgrave there is groundwater flow from the Nottawasaga River watershed into the Humber watershed. Land use decisions in these areas have the potential to affect environmental conditions in the Humber watershed. Similarly, groundwater also flows out of the Humber watershed and into the groundwater systems of the Rouge River and Don River watersheds due to the influence of a bedrock valley aquifer system.

Urbanization has the potential to affect the functions of groundwater recharge and discharge areas. In recharge areas, an increase in impervious cover reduces the amount of rain and snowmelt that infiltrates into the ground, lowering water tables unless mitigation measures are applied. In discharge areas, lowering of the water table may reduce groundwater contributions to watercourses. It is important to maintain the pattern and volume of groundwater discharge especially where vegetation and wildlife communities depend on it.

Figure 3–3: Physiographic regions

Humber River Watershed

Physiographic Regions

LEGEND

- Watershed Boundary*
- Municipal Boundary
- Road
- Watercourse**

PHYSIOGRAPHIC REGIONS

- Lake Iroquois Sand Plain
- South Slope
- Peel Plain
- Oak Ridges Moraine
- Horseshoe Moraine
- Guelph Drumlin Field
- Niagara Escarpment

SECONDARY SUBWATERSHED UNITS*			
#	NAME	#	NAME
1	MAIN - UPPER	13	KING CREEK
2	MAIN - PALGRAVE TO BOLTON	14	EAST - NOBLETON TO KLEINBURG
3	CENTREVILLE CREEK	15	PURPLEVILLE CREEK
4	COLD CREEK	16	EAST - KLEINBURG TO WOODBRIDGE
5	MAIN - BOLTON TO WOODBRIDGE	17	BLACK CREEK
6	RAINBOW CREEK	18	LOWER - WOODBRIDGE TO REXDALE
7	WEST - WEST BRANCH	19	EMERY CREEK
8	WEST - MAIN BRANCH	20	LOWER - REXDALE TO WESTON
9	WEST - EAST BRANCH	21	BERRY CREEK
10	WEST - LOWER BRANCH	22	HUMBER CREEK
11	ALBION CREEK	23	SILVER CREEK
12	EAST - UPPER BRANCH	24	LOWER - LAMBTON TO MOUTH

0 2 4 8 12 Kilometres

*Watershed/Subwatershed boundary has been derived from the Humber River Hydrology Model drainage boundaries.
**Watercourse has been generalized for mapping purposes.

Date: August, 2008
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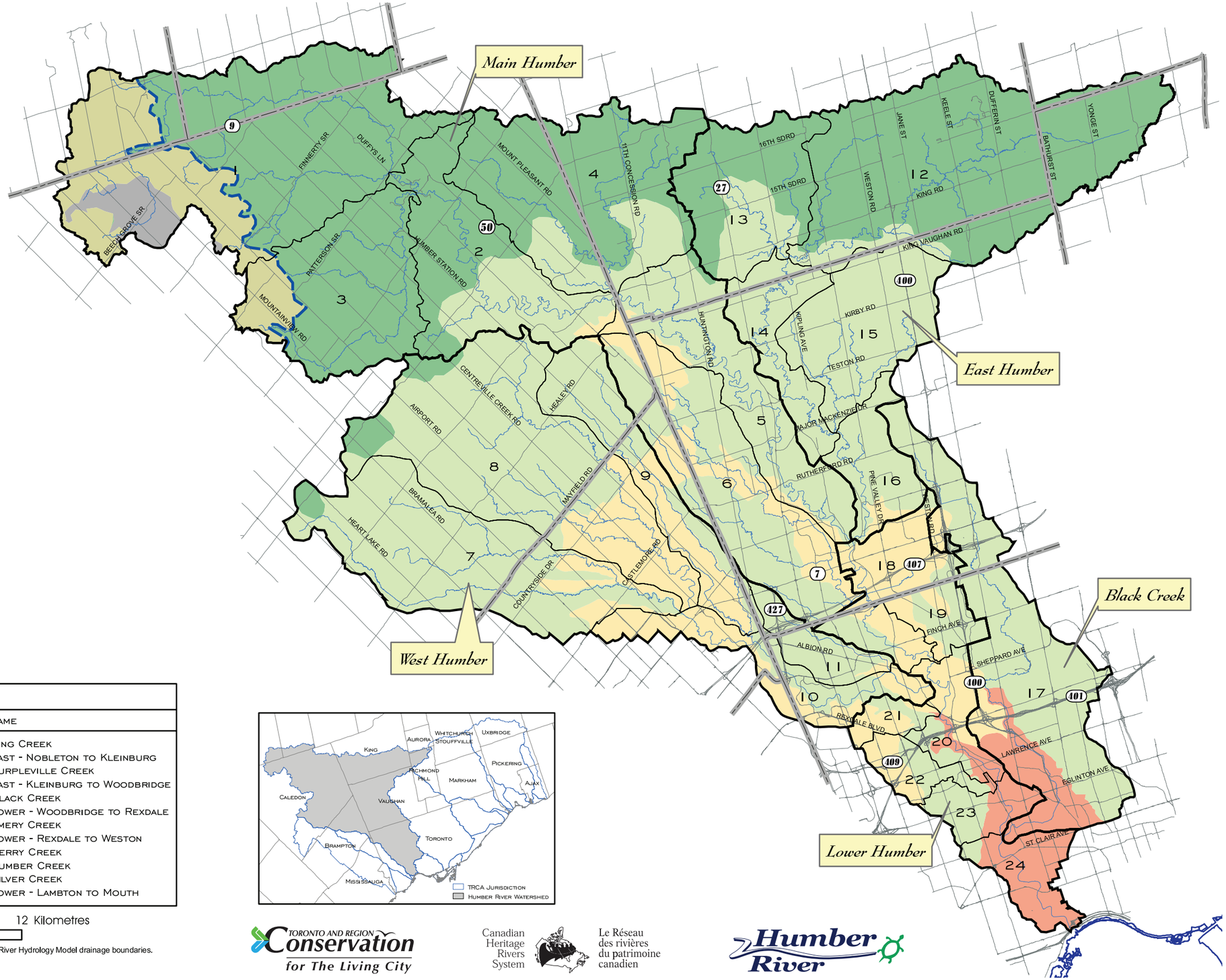

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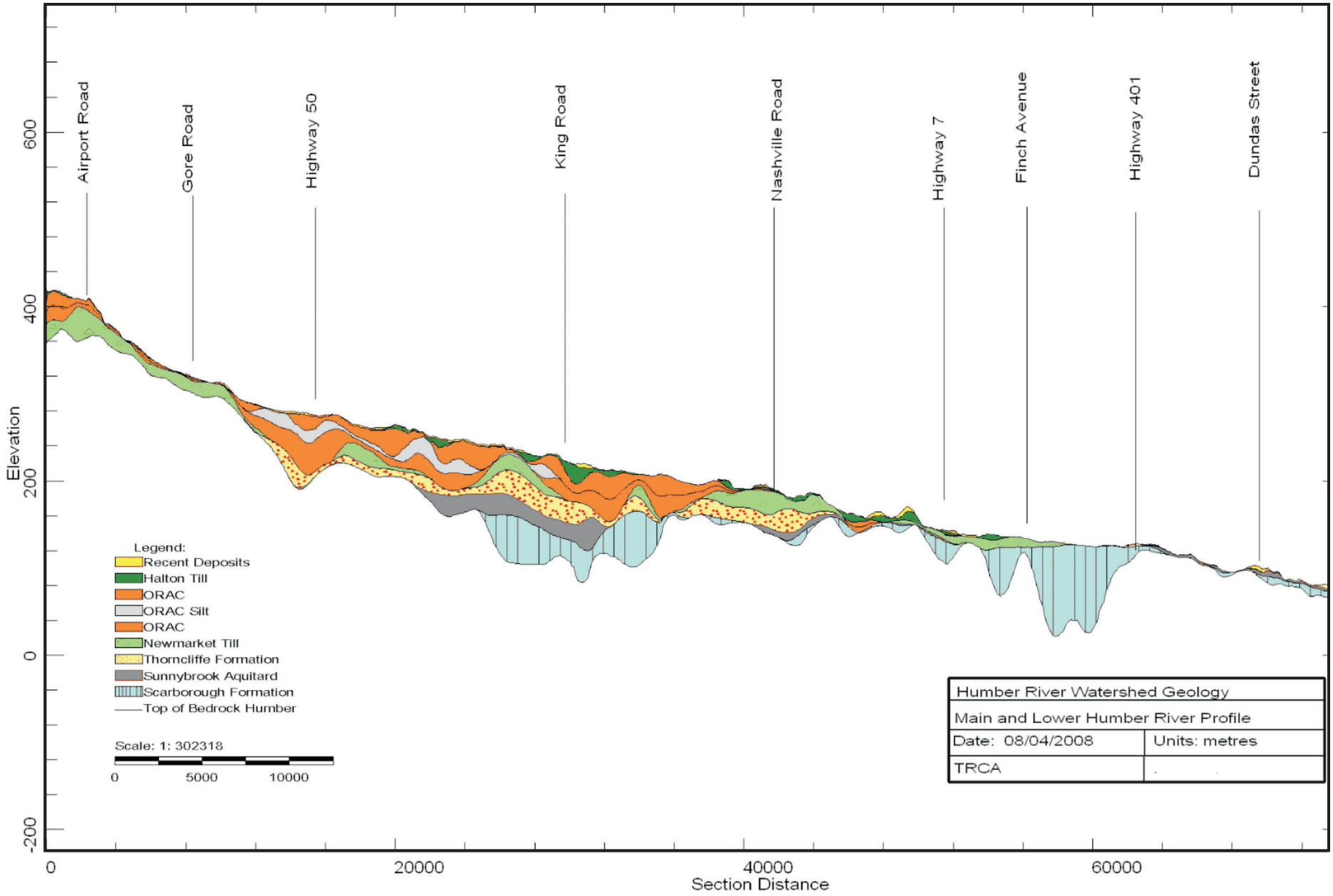
Humber River

Figure 3–4: Geologic model cross-section



The major zone of groundwater discharge to streams within the Humber watershed occurs along the southern flank of the Oak Ridges Moraine. Another zone of discharge occurs south of the Lake Iroquois Shoreline where the deeper aquifer complexes (Thorncliffe and Scarborough aquifers) discharge directly to the watercourse or create seeps along the riverbanks.

Approximately 7,340,000 cubic metres of groundwater (about 6 per cent of total annual recharge) is withdrawn from the major aquifer systems each year. About 47 per cent of the withdrawals are from 13 municipal wells in the watershed, with the remainder for private wells, agricultural irrigation, industrial processing, commercial and recreation purposes (e.g., golf course irrigation). Although 6 per cent of annual recharge is considered low stress, local ratios of withdrawal to recharge may be higher because wells are generally concentrated in the upper portions of the watershed.

Figure 3–6 presents the watershed's water budget, which summarizes the components of the water cycle on an average annual basis, accounting for both natural elements and human activities. As explained below, appropriate management of this water balance is important to sustain biological systems, ensure safe flow regimes and protect water supplies. Critical concerns are the potential impacts on recharge, groundwater levels and runoff that may result from urban development, water withdrawals and climate change.

Aquifer water levels are considered stable at present and groundwater quality sampling shows that Ontario Drinking Water Standards, Objectives and Guidelines and Provincial Water Quality Objectives are met. High concentrations of iron and manganese in samples from the Bolton and the Village of Nobleton monitoring wells are probably due to natural levels of minerals in the rock or soils in these areas. Risk of contamination of groundwater from road de-icing salt remains an issue, particularly for shallow wells along high traffic roads in rural areas where residents rely on private wells for water supplies.

Aquifers are most vulnerable to the potential migration of contaminants along the Oak Ridges Moraine and south of the Lake Iroquois Shoreline. The South Slope till plain has generally lower vulnerability, due to its thick, less permeable till and glaciolacustrine deposits.

Water Cycle

The water cycle refers to the pathways and storage of water in various parts of the ecosystem. Precipitation in the form of rain or snow may follow one of three pathways:

1. It can infiltrate into the ground, contributing to the recharge of groundwater aquifers and may emerge later as discharge that contributes to springs or baseflow in streams.
2. It can be returned into the air as water vapour by evapotranspiration from the ground, buildings, plants and other surfaces.
3. The remainder runs over the ground as surface runoff (stormwater) and finds its way into storm drains or watercourses.

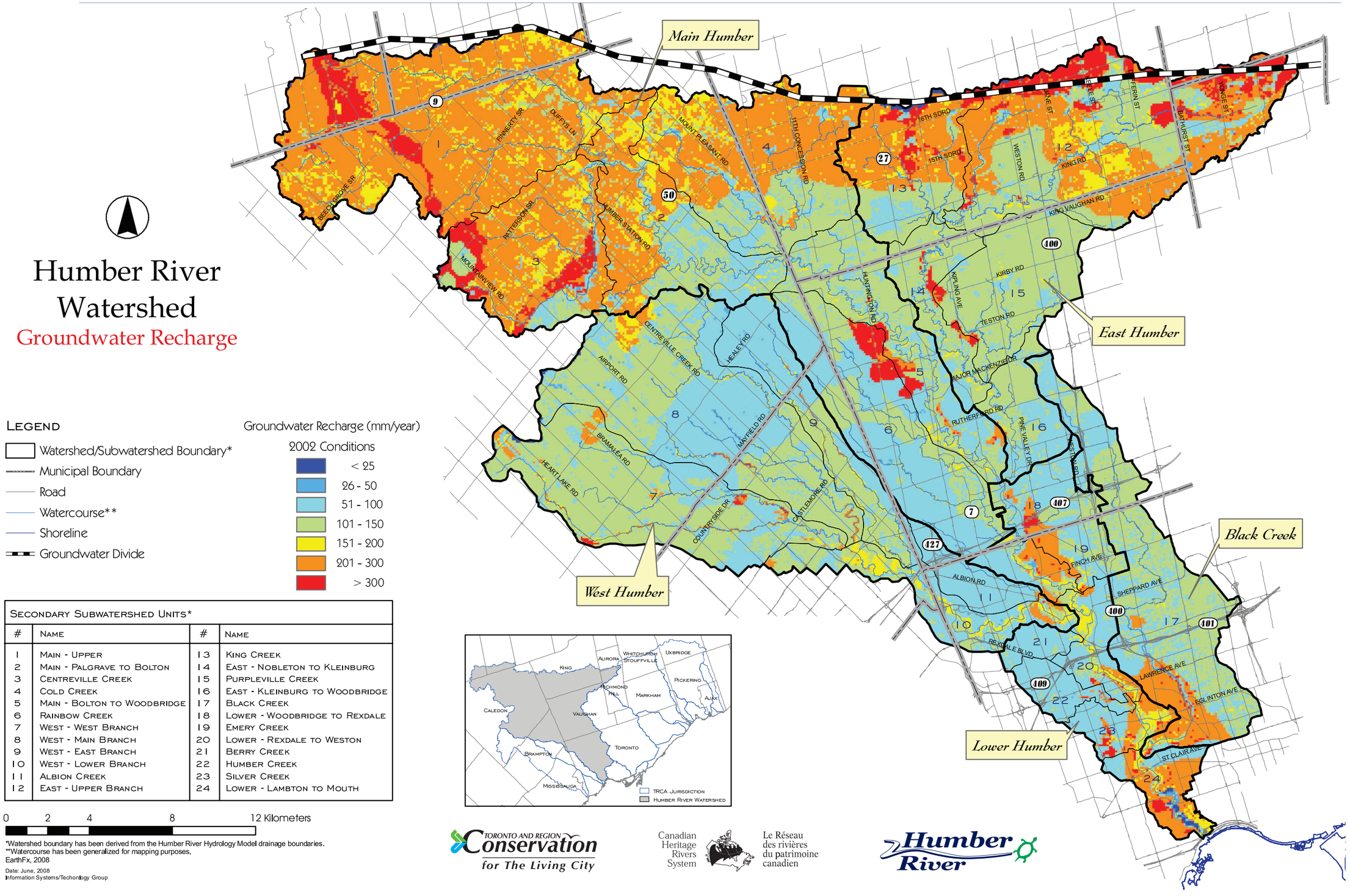
Urbanization removes much of the natural vegetation that would otherwise intercept, slow down and return water to the atmosphere. Grading eliminates natural depressions that capture and store surface water. Roads and buildings create impervious surfaces that prevent infiltration and increase surface runoff.

In the past, storm sewers collected urban runoff and conveyed it to nearby streams, bypassing the natural filtration process that occurs when water is allowed to infiltrate into the soil. Present practices capture runoff and treat it, using a variety of stormwater management technologies.

The increased surface runoff from urban areas results in a chain of effects in watercourses including higher peak flows and water levels, increased flood risks, accelerated stream bank erosion, poor water quality, warmer water temperatures and degraded aquatic habitats.

Reductions in groundwater recharge limit the supply of water to aquifers and reduce groundwater discharge to streams.

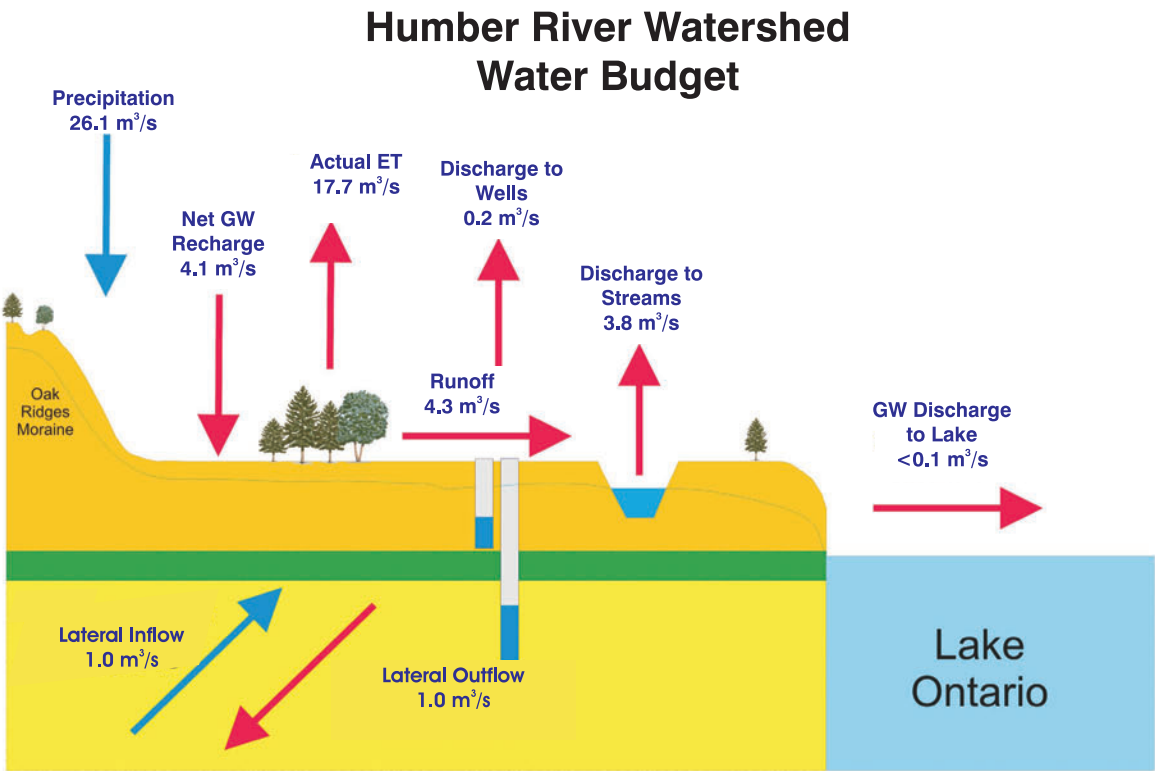
Figure 3–5: Groundwater recharge



Key issues

- Need to protect drinking water sources from potential sources of contamination or reduction in availability
- Potential for urban development to change groundwater levels, flow paths and patterns of groundwater discharge
- Land use decisions in watersheds bordering the Humber to the north and west have the potential to affect environmental conditions in the Humber watershed
- Land use decisions in the portion of the Humber watershed bordering the Rouge River and Don River watersheds have the potential to affect environmental conditions in those watersheds

Figure 3–6: Water budget (2002 land use/land cover conditions)



Notes: m3/s = cubic metres per second; Time period = average annual; ET = evapotranspiration; GW = groundwater; Lateral Inflow = flow of groundwater into watershed from adjacent watersheds; Lateral Outflow = flow of groundwater out of watershed to adjacent watersheds.

3.2.4 SURFACE WATER QUANTITY

The Humber watershed can be subdivided into five primary subwatersheds—the Main Humber, the East Humber, the West Humber, Black Creek and the Lower Humber, which can be further divided into 24 secondary subwatersheds (Figure 3–7). They range from mostly rural to entirely urbanized.

Previous urban drainage practices have significantly affected the natural surface water flow regimes in most of the subwatersheds in the southern portions of the Humber watershed. The effects of urbanization and associated increases in impervious cover include significant increases in the volume, severity and frequency of surface

2007 Report Card

- How well is stormwater runoff from urban areas being managed?

  Rating: F

- How stable are the flows in the river?

  Rating: C

flows, especially in summer months, along with the potential for localized reductions in baseflows during dry weather. Unfortunately, even modern stormwater management measures have been found to be inadequate in preventing most of these impacts. Unstable stream banks and accelerated channel erosion affect aquatic and terrestrial habitats. They also threaten the integrity of public infrastructure, such as bridges and underground pipes, resulting in high costs of repair or disruption in service to the public.

The headwaters of the Main Humber subwatershed originate in the Niagara Escarpment and Oak Ridges Moraine (ORM), and the river continues down the South Slope to the Peel Plain. The permeable soils and hummocky terrain of the ORM result in relatively high recharge, high baseflow rates and low surface runoff. The Main Humber subwatershed contributes over half of the total baseflow (dry weather flow) in the Humber River. Further south, in the lower reaches of the Main Humber, including Rainbow Creek, the clay soils of the Peel Plain have much lower recharge rates and a larger portion of precipitation becomes surface runoff under natural conditions. The potential impacts of urbanization on stream flow and groundwater levels are therefore not as great in these low recharge areas as in areas with high recharge. Most of the Main Humber subwatershed is agricultural with significant natural areas. Existing urban settlements include Bolton, Caledon East, Palgrave, the Village of Kleinburg and Woodbridge.

Centreville Creek, a headwater tributary to the Main Humber.
Photography by Lou Wise

The headwaters of the East Humber subwatershed are on the Oak Ridges Moraine. There are also a number of kettle lakes and other internally drained areas in King Township, Richmond Hill and Aurora. Soils in this subwatershed tend to be clay loams, with large pockets of sandy loam, loam and silt. Land use remains predominantly agricultural, though the settlements of Oak Ridges, the Village of King City, the Village of Nobleton and portions of Woodbridge are within the subwatershed. The East Humber subwatershed contributes considerable baseflow to the Humber system (about 20 per cent of total flow), particularly from tributaries on the ORM and from Purpleville Creek.

Kettle ponds and wetlands, in the East Humber subwatershed.
Photography by Lou Wise

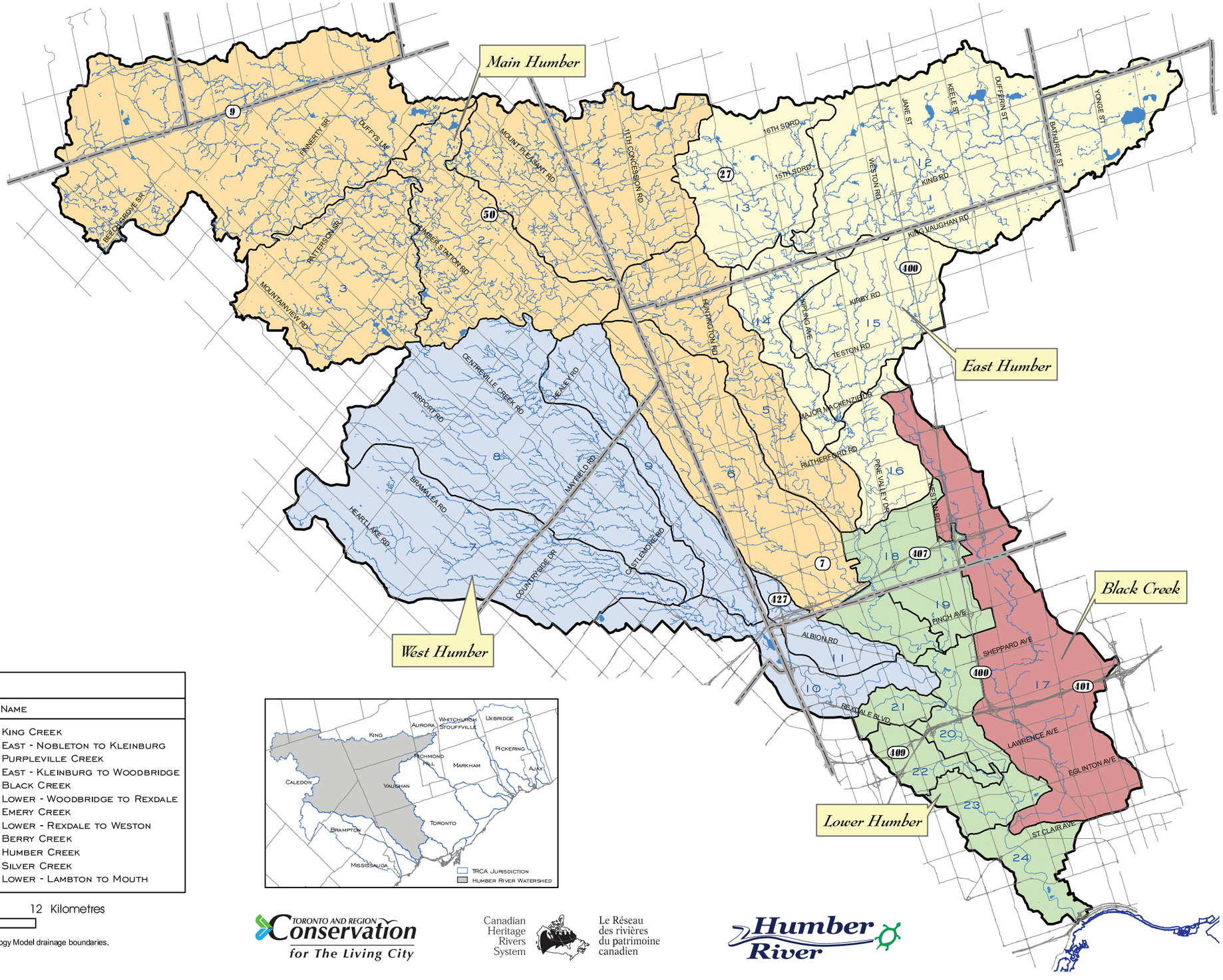
The West Humber has its headwaters in the South Slope, but most of the rest of the subwatershed is in the Peel Plain. As a result of the predominance of poorly drained clay and clay till soils, baseflow in the West Humber tributaries tends to be low, with even large tributaries often drying up in the summer months. This subwatershed is therefore

The headwaters of the West Humber occur on the farmlands of the South Slope and Peel Plain.
Photography by Lou Wise

Figure 3–7: Subwatersheds

Humber River Watershed

Subwatersheds



Legend

- Watershed Boundary*
- Municipal Boundary
- Road
- Pond & Lake
- Watercourse

Secondary Subwatershed Units*			
#	Name	#	Name
1	Main - Upper	13	King Creek
2	Main - Palgrave to Bolton	14	East - Nobleton to Kleinburg
3	Centreville Creek	15	Purpleville Creek
4	Cold Creek	16	East - Kleinburg to Woodbridge
5	Main - Bolton to Woodbridge	17	Black Creek
6	Rainbow Creek	18	Lower - Woodbridge to Rexdale
7	West - West Branch	19	Emery Creek
8	West - Main Branch	20	Lower - Rexdale to Weston
9	West - East Branch	21	Berry Creek
10	West - Lower Branch	22	Humber Creek
11	Albion Creek	23	Silver Creek
12	East - Upper Branch	24	Lower - Lambton to Mouth

0 2 4 8 12 Kilometres

*Watershed boundary has been derived from the Humber River Hydrology Model drainage boundaries.

Date: February, 2007
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Humber River

the most sensitive to reductions in baseflow (from water use or groundwater changes). The upper half of the subwatershed within the Town of Caledon remains primarily agricultural, while the City of Brampton portion has been, or soon will be, developed for residential, commercial and industrial purposes. The lowest part of the subwatershed in the City of Toronto was developed some time ago for residential, commercial and industrial uses.

The Black Creek subwatershed has been entirely developed, resulting in approximately 48 per cent impervious cover. Most of the older residential and industrial development in the City of Toronto occurred prior to the adoption of stormwater quantity and quality control measures. As a result, flooding became a significant hazard in this area and large reaches of Black Creek were transformed to concrete channels to direct water downstream as quickly as possible following storm events. Runoff therefore tends to be flashy with relatively high peak flows during storm events.

Black Creek is a fully urbanized subwatershed.
Photography by Lou Wise

The Lower Humber River carries water off the Peel Plain through the Iroquois Sand Plain to Lake Ontario. This subwatershed is entirely developed, with several large pockets of older industrial lands. Similar to Black Creek, the majority of the subwatershed was developed with little to no modern stormwater management controls, although several major stormwater management retrofit projects have recently been implemented in the City of Toronto. Subwatershed imperviousness for tributaries in this part of the watershed ranges from 59 per cent (Berry Creek) to 74 per cent (Emery Creek).

The mouth of the Humber River at the Lake Ontario waterfront in Toronto.
Photography by Lou Wise

Since the late 1970s, developments in the watershed have incorporated stormwater management ponds, initially for flood control. In the early 1990s, there was a shift to facilities that provide water quality and erosion control in addition to quantity control. However, monitoring of environmental conditions shows that this infrastructure is still not adequate to protect the river system from negative impacts. For example, recent studies of Eckardt Creek, in the Rouge River watershed, show that even with state-of-the-art stormwater ponds, development has destabilized the natural channel structure, indicating that control of surface runoff volume is needed in order to retain a more natural water balance.

Depending on when development occurred, different urban areas in the Humber watershed have different levels of stormwater control. About 75 per cent of the urban areas, generally those developed before 1980, have no stormwater controls. About 6 per cent have quantity controls, nearly 15 per cent have quantity and quality controls, and 4.2 per cent of urban areas have been retrofitted to provide varying degrees of stormwater control (Figure 3–8). Even where stormwater management facilities (e.g., ponds, oil and grit separators) are in place, they need to be cleaned out periodically to maintain their designed level of performance. Not all Humber municipalities have operations and maintenance programs for their stormwater facilities, largely

because they do not have sustainable funding mechanisms to support them.

The risk of flooding remains a key issue in many locations, including Bolton, Woodbridge, Oak Ridges and the City of Toronto, because they were developed prior to implementation of regulations that keep development out of the flood plain. Figure 3–9 illustrates locations of flood vulnerable areas and roads, and Figure 3–15 shows areas designated as Special Policy Areas (SPAs) by the Province of Ontario due to risk of flooding. New or intensified development is generally not permitted in SPAs (see text box), unless there are no other feasible opportunities. However, some of these areas are designated for intensification in municipal official plans or in the Growth Plan for the Greater Golden Horseshoe and will require further measures to manage flood risks. For example, the City of Toronto Official Plan identifies the area around Jane St. and Wilson Ave. as an area for intensification but portions are within the floodplain of Black Creek and are designated as a SPA. Careful management of developments within flood prone areas, as well as in upstream drainage areas, is required to minimize risks to life and property.

What is a Special Policy Area (SPA)?

Under the Ontario Planning Act, municipalities are directed to ensure that any new development is not permitted in areas where there is an unacceptable risk to public health, safety or property due to hazards such as flooding. Some historic areas that were developed prior to this policy approach have been designated as Special Policy Areas to provide for the continued viability of existing uses, provided that flood hazard management measures are taken (e.g., flood-proofing, flood remediation and risk reduction). There are currently five provincially designated Special Policy Areas in the Humber watershed (Figure 3.15., Special Land Use Policy Areas).

Flooding of Jane Street near Highway 7 during August 19, 2005 storm event.

Water withdrawals for agricultural, commercial and water supply purposes can have significant local and watershed wide effects on surface water flows. Overall, water use in the Humber is predominantly for agricultural irrigation, accounting for 42 per cent of the total annual withdrawals. Withdrawals for commercial use and water supply are also major water use sectors, comprising 30 per cent and 18 per cent respectively.

A total of 262 users of surface water withdraw approximately 2.3 per cent of available baseflow in the Humber River in an average year. While this does not seem to be a large proportion, use varies considerably among subwatersheds. For example, more than 17 per cent of average annual baseflow is withdrawn from the West Humber subwatershed. It is also important to consider where the withdrawals are occurring in a subwatershed. Even relatively small water takings from headwater streams can have significant local and downstream effects on water availability and aquatic habitat.

Figure 3–8: Stormwater management controlled areas

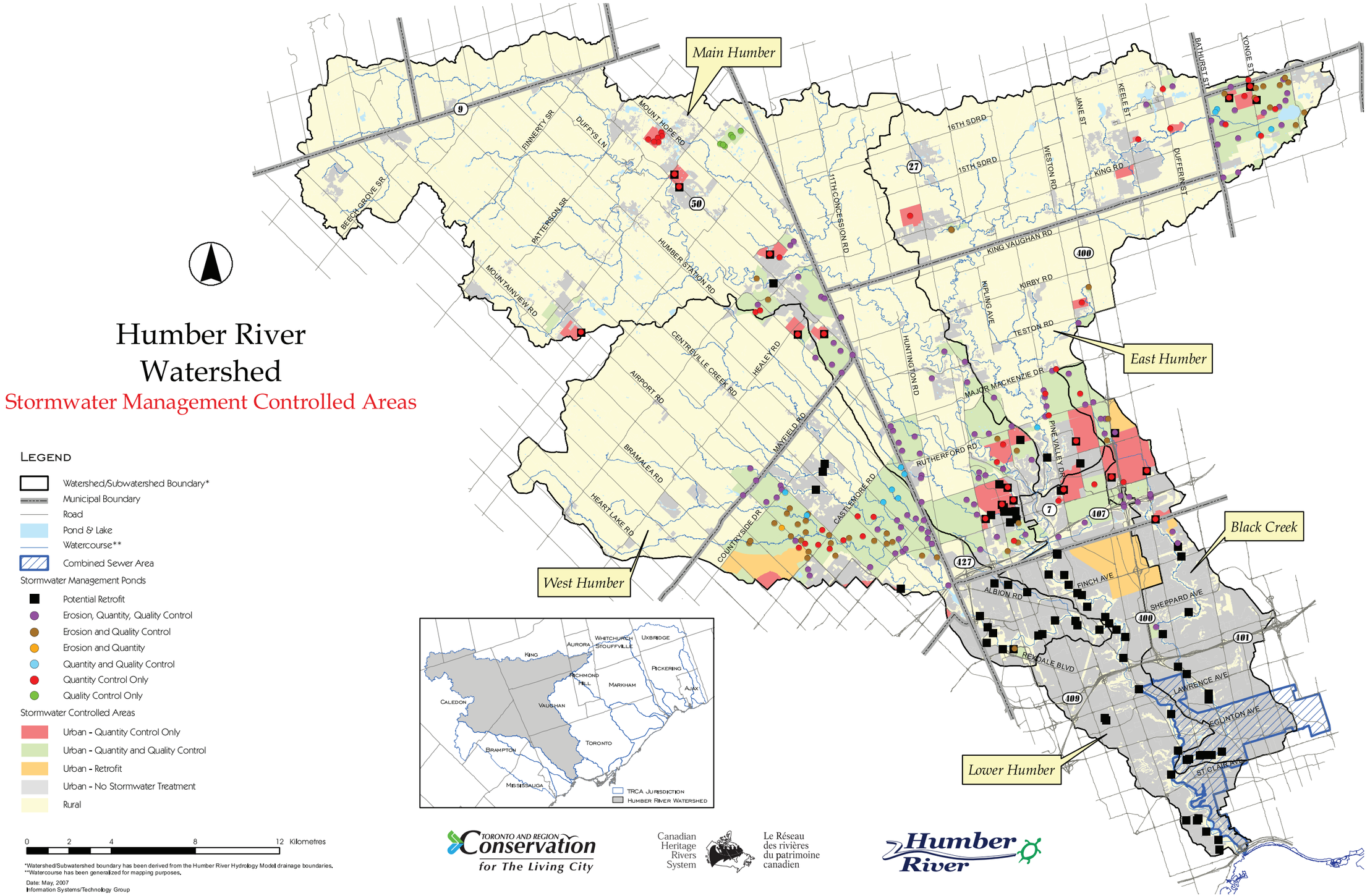
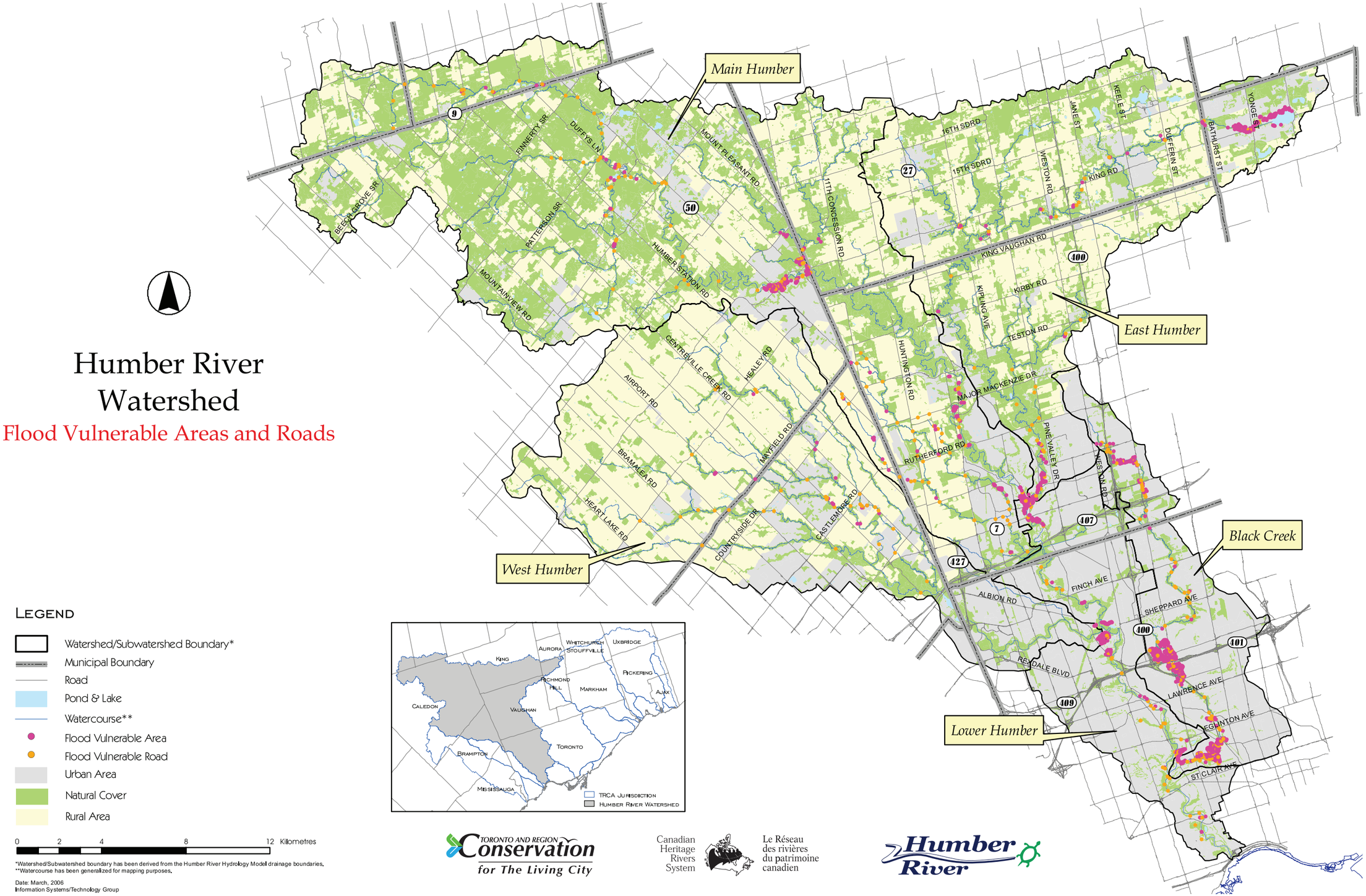


Figure 3–9: Flood-vulnerable areas and roads



Humber River Watershed

Flood Vulnerable Areas and Roads

Legend

- Watershed/Subwatershed Boundary*
- Municipal Boundary
- Road
- Pond & Lake
- Watercourse**
- Flood Vulnerable Area
- Flood Vulnerable Road
- Urban Area
- Natural Cover
- Rural Area

0 2 4 8 12 Kilometres

*Watershed/Subwatershed boundary has been derived from the Humber River Hydrology Model drainage boundaries.
**Watercourse has been generalized for mapping purposes.

Date: March, 2006
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Humber River

Key issues

- Continued urbanization is increasing surface runoff, total flow volumes, watercourse instability and erosion.
- Many existing urban areas lack stormwater management controls. Many areas have only quantity (not quality) controls.
- Previous and current stormwater management measures are inadequate to protect river systems from erosion.
- Older stormwater management facilities are likely in need of maintenance to ensure their designed level of performance, but funding mechanisms are not yet available.
- Careful management of developments within flood prone areas, as well as in upstream drainage areas, is required to minimize risks to life and property.
- Surface water takings can have significant local and downstream effects on water availability and aquatic habitat.

3.2.5 SURFACE WATER QUALITY

2007 Report Card

- How swimmable are surface waters?

Rating: F

- How degraded are surface waters with respect to conventional pollutants?

Rating: C

- What is the condition of surface water with respect to heavy metals and organic compounds?

Rating: C

Surface water quality varies widely from the upper to the lower portions of the Humber watershed. Quality is reasonably good in the upper portions–Cold Creek, Centreville Creek and the Upper Main Humber–due to the inputs of clean groundwater from the Oak Ridges Aquifer. Even the East Humber, which has experienced moderate levels of urbanization over the past 10 years, remains relatively clean. In contrast, the lower reaches of streams in the West Humber, with its clay soils, low groundwater discharge rates and urbanizing landscape, exhibit the poorest overall water quality in the Humber River watershed. Conditions at the mouth of Black Creek and in the Lower Humber are also poor. The absence of modern stormwater management controls in the older urban developments in these subwatersheds contributes significantly to surface water pollution. In addition, portions of Black Creek and Lower Humber subwatersheds in the City of Toronto are serviced by combined sewers, which allow human sewage to be mixed with stormwater during large storm events, and discharged directly to streams and eventually to Lake Ontario (Figure 3–8). Improvements to infrastructure in these areas are planned over the next 50 years to reduce risk of surface water contamination from overflow of combined sewers.

Sediment plume along the Lake Ontario waterfront from the Humber River following a major storm event.
Photography used with permission from the City of Toronto.

The concentration of suspended solids in surface waters is a particularly important water quality indicator because solid particles act as a primary transport vector for other contaminants, such as phosphorus, most heavy metals and bacteria. Poor water clarity also affects aquatic habitats and species. Construction sites are a significant source of sediments in urbanizing areas. The current application of erosion and sediment control technologies on urban construction sites and enforcement capabilities of government agencies are inadequate to address this issue.

Levels of suspended solids are highest in the West Humber (where easily eroded clay soils predominate) followed by the Lower Humber.

Bacteria levels in the Humber watercourses often fail to meet the provincial guideline for recreational swimming, even on streams dominated by natural and rural land uses. For instance, only 29 per cent of water samples collected in the mostly rural Centreville Creek subwatershed from 1999 to 2003 met the guideline.

Lake Ontario waterfront beaches and inland beaches at Lake Wilcox and Albion Hills Conservation Area are monitored and posted when bacteria exceed safe levels for swimming. Most of them were unsafe during most of the swimming season in 2004, with the exception of Albion Hills Conservation Area, where the enclosed beach area is chlorinated. The three Toronto waterfront beaches were closed most frequently, in large part due to their close proximity to the mouth of the Humber River, which is a source of significant bacterial contamination.

The *Provincial Water Quality Objective* for phosphorus in receiving waters was rarely met anywhere in the Humber between 1999 and 2003. Even during dry weather, effluent concentrations from stormwater ponds and wetlands are typically at least double the *Provincial Water Quality Objective* for phosphorus.

Chloride is a major component of de-icing salts applied to roads during the winter. Chloride levels in the Humber River are rising due to increasing urbanization. Winter levels in the Lower Humber, West Humber and Black Creek are often above the threshold established by Environment Canada to protect aquatic life. Unfortunately, current stormwater management practices do little to mitigate chloride levels because chloride is not removed by ponds and wetlands.

Trends in water quality at the Old Mill sampling station on the Lower Humber have been assessed for copper, zinc, total suspended solids, chloride and phosphorus. Chloride was the only one that showed an upward trend. This suggests that stormwater management controls in newly developed areas upstream appear to be effective in removing contaminants associated with suspended sediment, such as copper, zinc and phosphorus, which would otherwise be expected to show increased levels. However, the infrastructure needs to be periodically maintained to continue to be effective.

Organic and inorganic chemicals enter watercourses through spills or accidental discharges. Between 1988 and 2000, there were approximately 900 oil spills and 750 chemical spills in the Humber watershed, of which roughly half drained directly to the Humber River or one of its tributaries. The chemical manufacturing and transportation sectors contributed the most volume of chemical spills, often as a result of container or fuel tank leaks.

Key issues

- Inadequate stormwater management control in older urban areas
- Risk of contamination from overflow of combined sewers in older urban areas during large storm events
- Need for maintenance of stormwater management infrastructure
- Inadequate application of erosion and sediment controls on urban construction sites and enforcement capabilities
- Impacts of pollutants and increasing chloride concentrations on aquatic life
- Impacts of bacteria levels on recreational opportunities
- Continued occurrence of spills

Stream channels showing signs of accelerated erosion and instability in Black Creek (top left and right), the West Humber (bottom left) and East Humber (bottom right)

3.2.6 STREAM FORM

Stream form refers to the physical form of rivers, creeks, channels, valleys and flood plains. In pristine settings, stream form generally changes in a constant but gradual way, through erosion and deposition in response to natural variations in stream flow. Urbanization in portions of the Humber watershed has significantly increased runoff and stream flows, resulting in rates of stream form change and erosion that are much greater than natural levels. This, in turn, leads to widening and deepening of the channels, pollution of the water by eroded soil materials and increased sediment loading downstream. As stream bed and bank sediments are scoured away or altered by deposited sediment, bank vegetation washes away. The unstable banks prevent new vegetation from becoming established, and the channel bed and banks lose the variety of physical habitats needed to support many aquatic species. As land is eroded away, property values may be affected and infrastructure, such as sewers, pipelines and road crossings, can become exposed and damaged.

Based on assessments completed in 2001, signs of stream channel instability were observed at most monitoring sites. Specifically, stream channels in the Black Creek subwatershed, Rainbow Creek, and tributaries to the Lower Humber (Albion Creek, Berry Creek, Emery Creek, Humber Creek and Silver Creek) were found to exhibit the greatest evidence of instability. Reaches within the Black Creek and Lower Humber subwatersheds in the City of Toronto and within the West Humber subwatershed in the City of Brampton have been identified as needing naturalization to address channel erosion issues and improve aquatic habitat.

Infrastructure or private property at risk of damage from stream channel erosion often needs costly protective measures to be put in place that require long-term maintenance.

Natural riparian vegetation (within 30 metres of the stream bank) is present along only 61 per cent of the river and stream banks in the watershed, indicating that a significant portion of stream banks lack the protection that vegetation can provide.

Key issues

- Unnaturally high rates of erosion
- Lack of channel stability
- Habitat degradation
- Reaches with little or no riparian cover
- Infrastructure and private property at risk of exposure, damage or failure

3.2.7 AIR QUALITY

2007 Report Card

- How healthy is the air we breathe?

Rating: D

The *Air Quality Index* exceeded 50, indicating "smog days", eight times in 2003, once in 2004 and 11 times in 2005. The low number of smog days in 2004 was due to a relatively cool summer rather than a reduction in air emissions. Fine particulate matter also exceeded provincial criteria. The major sources of contaminants responsible for smog and particulates are motor vehicles, power generation and industrial processes. Local and regional sources of pollution cause 50 per cent of the smog in the Greater Toronto Area, with the remainder from more remote sources. Vehicle use, a key contributor to air pollution, continues to rise. There were over 2.7 million registered vehicles in the Regional Municipality of Peel, the Regional Municipality of York, and the City of Toronto in 2004, an increase of 31 per cent since 1998.

Hot, sunny weather is known to accelerate the chemical reactions that form ground level ozone resulting in smog. Climate change models predict that average annual air temperatures in the Great Lakes Basin could rise by 5–10 C by 2080. If this change results in hotter summers it can be anticipated that the frequency of smog warnings will increase unless emissions of nitrogen oxides and volatile organic compounds are drastically reduced.

Key issues

- Increasing ground level ozone levels and number of smog days
- Impacts of air pollution on the health of humans, crops, plants and animals
- Increasing greenhouse gas emissions contribute to global climate change

3.2.8 AQUATIC SYSTEM

2007 Report Card

- How healthy are benthic invertebrate communities?

Rating: C

- How healthy is stream bank vegetation?

Rating: C

- How healthy are fish communities by subwatershed?

Ratings: East Humber B-
Main Humber C+
West Humber C
Black Creek D-
Lower Humber D

The range of physical conditions in the Humber watershed—from the headwaters on the Niagara Escarpment and Oak Ridges Moraine, through the clay plains in the middle portions and down to the river mouth on the Lake Ontario shoreline—is the foundation for a variety of aquatic habitats. Streams with no tributaries (known as first order streams) make up almost half of the 1,300 kilometres of watercourses in the watershed. Stream slopes range from greater than 5 per cent in the headwaters to the almost flat river mouth area. The Niagara Escarpment limestone and coarse sands and gravels of the Oak Ridges Moraine provide substantial groundwater discharge to many headwater streams, keeping water temperatures cold and flows stable. The clay soils found in the middle sections of the watershed absorb less water and have much higher runoff characteristics, resulting in significant fluctuations in stream temperatures and flows throughout the year.

The cold-water upper reaches of the Main Humber support self-sustaining populations of mottled sculpin, brook trout and brown trout (the latter is augmented by stocking). Sculpin are typically bottom dwellers that require clean substrates through most of their life cycle. Brook trout spawning habitat is characterized by the presence of groundwater upwellings, clear water and clean gravelly substrates. This supply of cold, clean water provides oxygen to eggs and prevents freezing through the winter months before emergence of fry in the spring. Chimney crayfish are also present in the headwaters and have similar habitat preferences to the other cold water fish species. The sustainability of this fish community reflects a healthy, functioning headwater system. However, recent monitoring indicates that aquatic habitats in the headwaters of the Humber River are now beginning to show signs of decline or stress where they are in proximity to urban development.

Further downstream, in the middle reaches of the watershed, the natural system shifts to cool water habitats supporting diverse communities of forage fish (e.g., white sucker and catfish), darters (e.g., Johnny, fantail and rainbow) and many minnow species, including populations of redside dace, an endangered species in the Province of Ontario. These species range from habitat specialists (e.g., redside dace, brassy minnow and brook lamprey) to generalists that are found moving through most of the available habitat. These diverse fish communities reflect the high diversity of habitats that naturally evolve as streams increase in size and become warmer.

In May, 2007, redside dace was listed as endangered (Schedule 3) by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and it is being considered for protection under the federal *Species at Risk Act*. Monitoring indicates that redside dace populations in the Humber River are primarily limited to the East and West Humber subwatersheds. New urban growth, which is anticipated in these subwatersheds, will likely affect known redside dace habitats, making the protection of this species and its habitat a high priority.

Rainbow Creek, Black Creek and the Lower Humber River are characterized by warm water habitats that have been affected to varying degrees by past and present urbanization. These reaches do not have significant groundwater inputs and stream flows are supplied primarily by

Redside dace.

surface runoff and from upstream catchments. The majority of the small tributaries to these systems have been lost or altered through landscape changes.

Historic records show that 75 fish species were documented in the watershed over the past 150 years, 64 of which are native. However, only 39 native fish species were sampled during 2004 aquatic surveys. Some of the fish that have disappeared from the watershed, or are now found in small numbers, are the larger fish-eating species as well as highly specialized species that are particularly sensitive to changing habitats. In total, 17 species of fish have been identified in the State of the Watershed Report on the Aquatic System (TRCA, 2008c) as being of local concern because they are rare, in decline, or have very specialized habitat requirements. The loss or decline of fish species in certain Humber subwatersheds have coincided with past land conversions to agriculture (in the middle and upper reaches) and urbanization (in the lower reaches). These land conversions have occurred over different time scales. Agricultural activity preceded intense urbanization and is associated with declines in specialist minnow species (e.g., blackchin shiner, brassy minnow and sand shiner) and catfish species. With the exception of Black Creek and the Lower Humber, intense urbanization is a more recent occurrence and is associated with greater loss or decline of fish higher up in the food web (e.g., yellow perch and bass) and less tolerant minnow species.

In pre-settlement times, the Humber River supported large runs of Atlantic salmon migrating upstream from Lake Ontario to reproduce in the upper tributaries on an annual basis. Landscape alteration associated with the establishment of new settlements, clearing of land for agriculture and dam building to establish mills contributed to the eventual disappearance of this species from the watershed by the mid-nineteenth century.

Changes to natural stream form and function related to landscape changes include increases in stream flow velocities, turbidity, siltation and temperature, all of which are incompatible with a healthy fish community. Current mitigation measures intended to protect aquatic habitat (e.g., sediment controls on construction sites and stormwater ponds) have not been consistently applied or effective. There is growing recognition by resource mangers to ensure due diligence and look for innovative ways to better mitigate impacts, including at-source stormwater management techniques.

Declines in the health of the benthic (bottom-dwelling) invertebrate communities were also identified through monitoring surveys conducted between 2002 and 2004. Analysis of the data indicates “unimpaired” aquatic habitats occurred at only 37 per cent of the monitoring stations in the watershed.

Stream-side or riparian vegetation is critically important to the quality of aquatic habitats.
Photography by Dean Young

For the first time in the Humber, freshwater mussels were sampled in 2004. This initial data suggests that the Humber River supports a diverse community of freshwater mussels including several species that have not been found in other TRCA watersheds. The presence of healthy communities of mussels is an indicator of healthy aquatic habitats.

Preliminary investigations have identified 1,201 potential in-stream barriers and stream crossings that could be limiting the movement of fish and other aquatic species. In-stream structures include four dams, four ponds, seven weirs, 1,100 road crossings, 25 railroad crossings and six trail crossings. An additional 61 structures have not yet been formally classified. It is likely that many of the road, railroad and trail crossings do not actually prevent fish passage, but formal barrier assessments are required to confirm which ones are barriers, either partial or complete, and to set priorities for mitigation. During the last 10 years, a number of dams and other barriers have been modified and, as a result, migratory rainbow trout from Lake Ontario have been returning to the East Humber to spawn every year since 2000.

A new non-native and invasive aquatic species, the rusty crayfish, was found in the Humber watershed in 2003. Since that time, the rusty crayfish appears to have expanded its range in the watershed. The rusty crayfish competes with native species of crayfish, reduces the abundance of aquatic plants, and affects the amount of food and habitat available for fish, particularly darters, sculpins, mudminnows and sunfish.

Other non-native invasive species in the watershed include sea lamprey, gobies and carp. Fortunately, they are currently confined to the lower Humber River, below the Old Mill weir. Proposals to modify in-stream barriers in the Lower Humber will need design considerations to prevent upstream movement of these species.

Stream-side or riparian vegetation is critically important to the quality of aquatic habitats because it stabilizes stream banks, creates shade that reduces water temperatures and provides

organic materials that contribute nutrients and habitat structure to the aquatic system. Natural vegetation cover occurs along 61 per cent of riparian areas (lands within 30 metres of the stream bank), with 35 per cent forest and the remainder cultural meadow (typically old farm fields), wetland or successional growth including shrubs and young trees. Environment Canada recommends a target of 100 per cent riparian cover, of which 75 per cent is forested. The Humber falls short of both targets, with existing natural riparian vegetation occurring as fragmented patches along many reaches. Without the shade that continuous corridors of riparian vegetation can provide, streams are more susceptible to warming from sun exposure. Stream temperature monitoring data in Rainbow Creek and the West Humber indicates unstable temperature patterns that largely coincide with the majority of riparian areas lacking natural cover.

Sport fishing occurs at many popular angling sites including the headwater areas, Humber Marshes, the Old Mill Dam, Glen Haffy Conservation Area and the Lower Humber up to Steeles Avenue. Fish consumption advisories issued by the Ministry of the Environment due to unacceptable levels of pollutants (polychlorinated biphenyls or PCBs, mercury and mirex) are in effect for many of the fish commonly caught in the Humber River. Fishing pressure is particularly intense in the spring and fall during the spawning runs of trout and salmon.

Fly fishing on the Humber River.
Photography by Jeff Hladun

Key Issues

- Generally poor quality aquatic habitats in most urban areas and some rural areas
- Sensitivity of many specialized aquatic species to impacts of urbanization
- Populations of redside dace will be affected by urban growth in the East and West Humber subwatersheds
- Sustained loss and risk of further loss of native aquatic species due to declining habitat and competition with invasive species
- Fragmented stretches of riparian vegetation
- Numerous in-stream barriers
- Fish consumption advisories

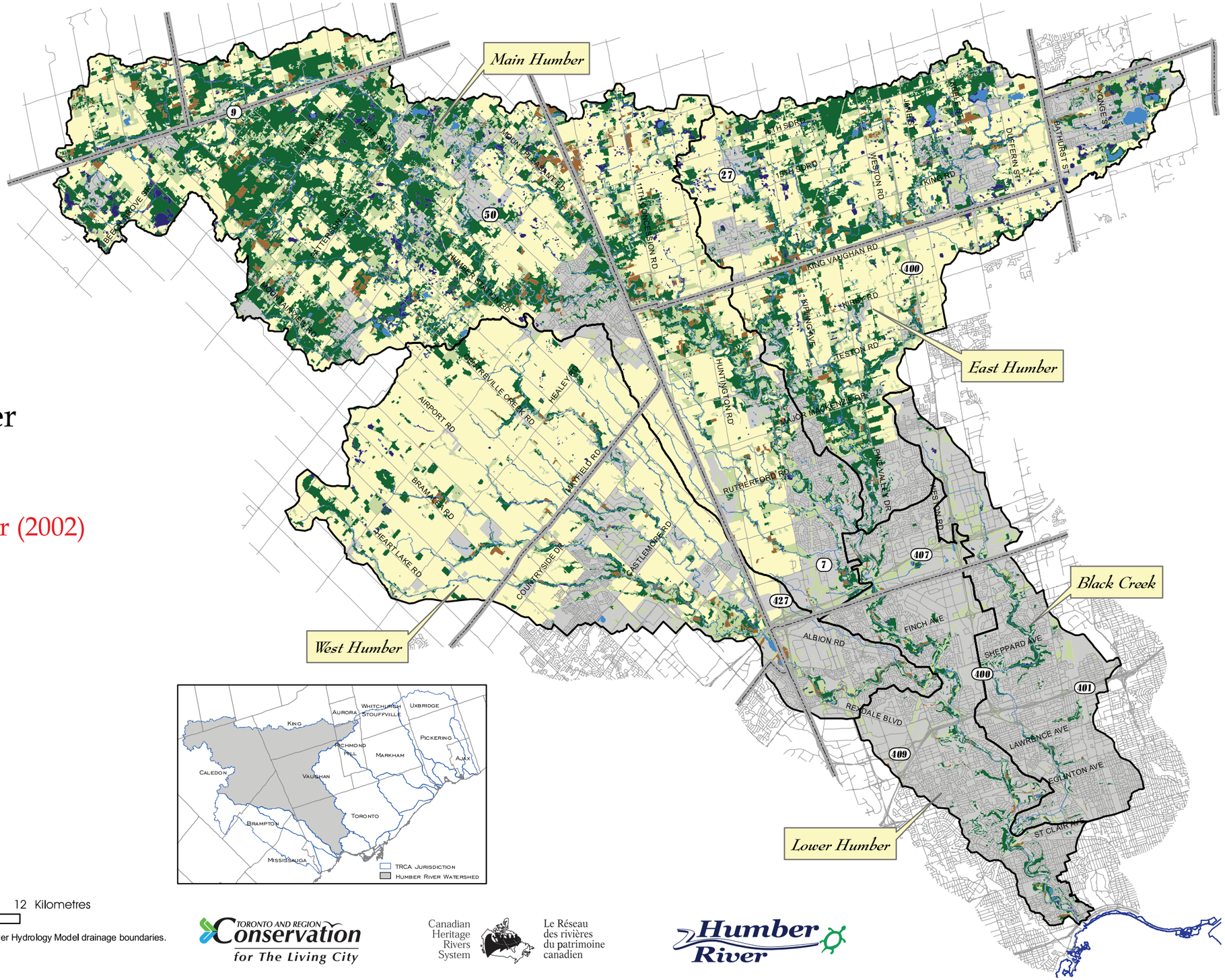
3.2.9 TERRESTRIAL SYSTEM

Natural cover, in the form of forests, wetlands, meadows, beaches and bluffs, covers about 32 per cent of the watershed. Forest cover is 19 per cent, cultural meadow is 11 per cent and less than two per cent is wetland and coastal communities (Figure 3–10). This is a relatively high percentage in comparison with many other watersheds in the Greater Toronto Area, and the Humber watershed makes an important contribution to the regional natural heritage system.

Cinnamon fern

Terrestrial habitats vary in different regions of the watershed: the Niagara Escarpment, Oak Ridges Moraine, South Slope, Peel Plain, Iroquois Sand Plain and the Lake Ontario Coastal Area. The following descriptions include some of the highlights of each region.

Figure 3–10: Natural, urban and agricultural land cover, 2002



Humber River Watershed

Natural, Urban, and Agricultural Cover (2002)

Legend

- Subwatershed Boundary*
- Municipal Boundary
- Road
- Pond & Lake
- Watercourse**
- Beach Bluff
- Forest
- Meadow
- Successional
- Wetland
- Urban
- Rural/Agriculture

0 2 4 8 12 Kilometres

*Subwatershed boundary has been derived from the Humber River Hydrology Model drainage boundaries.
**Watercourse has been generalized for mapping purposes.

Date: November, 2005
Information Systems/Technology Group

Toronto and Region Conservation for The Living City

Canadian Heritage Rivers System / Le Réseau des rivières du patrimoine canadien

Humber River

The headwater areas on the Niagara Escarpment and Oak Ridges Moraine include the greatest concentration of large forest blocks in the Humber watershed. The largest cluster of natural cover is in the most northwestern part of the watershed in the area of Centreville Creek, Palgrave and Albion Hills Conservation Area. It includes coniferous plantations, sandy meadows, mature sugar maple forests with small kettle wetlands and ponds surrounded by coniferous swamp. Provincially significant wetlands in the headwater region are noteworthy for their kettle bogs, high quality kettle lakes and high concentrations of sensitive species of plants and animals. They include many plants of conservation concern, such as waterweed, fragrant white water lily and coon-tail in the lakes; tamarack, leatherleaf and bog buckbean in the kettle bogs; water horsetail, winterberry and cinnamon fern in the kettle wetlands. Animals of conservation concern include many wetland-dependent birds such as sora, least bittern and wood duck, as well as amphibians such as bullfrog, grey tree frog and wood frog. Upland species of conservation concern include barred owl, ovenbird, bobolink and grasshopper sparrow. Rare vegetation communities in the headwaters include a tamarack leatherleaf kettle bog and a willow thicket swamp.

The South Slope includes some relatively high quality valley lands such as the Nashville Resource Management Tract, Cold Creek Conservation Area and the provincially significant King-Vaughan Wetland Complex. Outside these areas, natural habitats on the South Slope are highly fragmented with small upland forest patches scattered throughout the predominantly agricultural landscape. Sensitive bird species such as ovenbird, ruffed grouse, long-

Headwater region: provincially significant wetland complexes

- Eaton Hall – Mary – Hackett Lakes
- Philips – Bond – Thompson Lakes
- Centreville Creek
- Widget – Innis Lakes
- King – Vaughan
- Black Duck

Fragrant white water lily

Bull Frog

Least bittern

Long-eared owl

A view of the Humber marshes from Riverside Drive in Toronto.
Photography by Dean Young

eared owl, black-billed cuckoo and black-and-white warbler occur in the larger habitat areas. Cedar swamps and meadow marshes appear where there is groundwater seepage and include plants of conservation concern such as marsh pennywort, gold thread and golden saxifrage.

Much of the middle portion of the watershed, primarily located within the City of Vaughan and The City of Brampton, is located in the Peel Plain. This region is mostly flat or gently undulating, except for the ravines that carry streams toward Lake Ontario. The soils are heavy, fertile and support good farmland. The large forests of the Living City Campus at Kortright and Boyd Conservation Area are still able to support many species and vegetation communities of conservation concern. However, most natural areas are highly fragmented and support less diverse communities. Animals of conservation concern such as wood frog and wood thrush still occur in some locations such as Claireville Conservation Area, but it is doubtful that they will be viable over the long term unless the overall terrestrial system is enhanced.

The Iroquois Sand Plain occurs in a band along the southern portion of the watershed, south of Highway 401. This area is predominantly urban and little remains of the Carolinian and prairie habitats such as fescue sand barren, black oak tallgrass savannah and black oak forest that once dominated the landscape here.

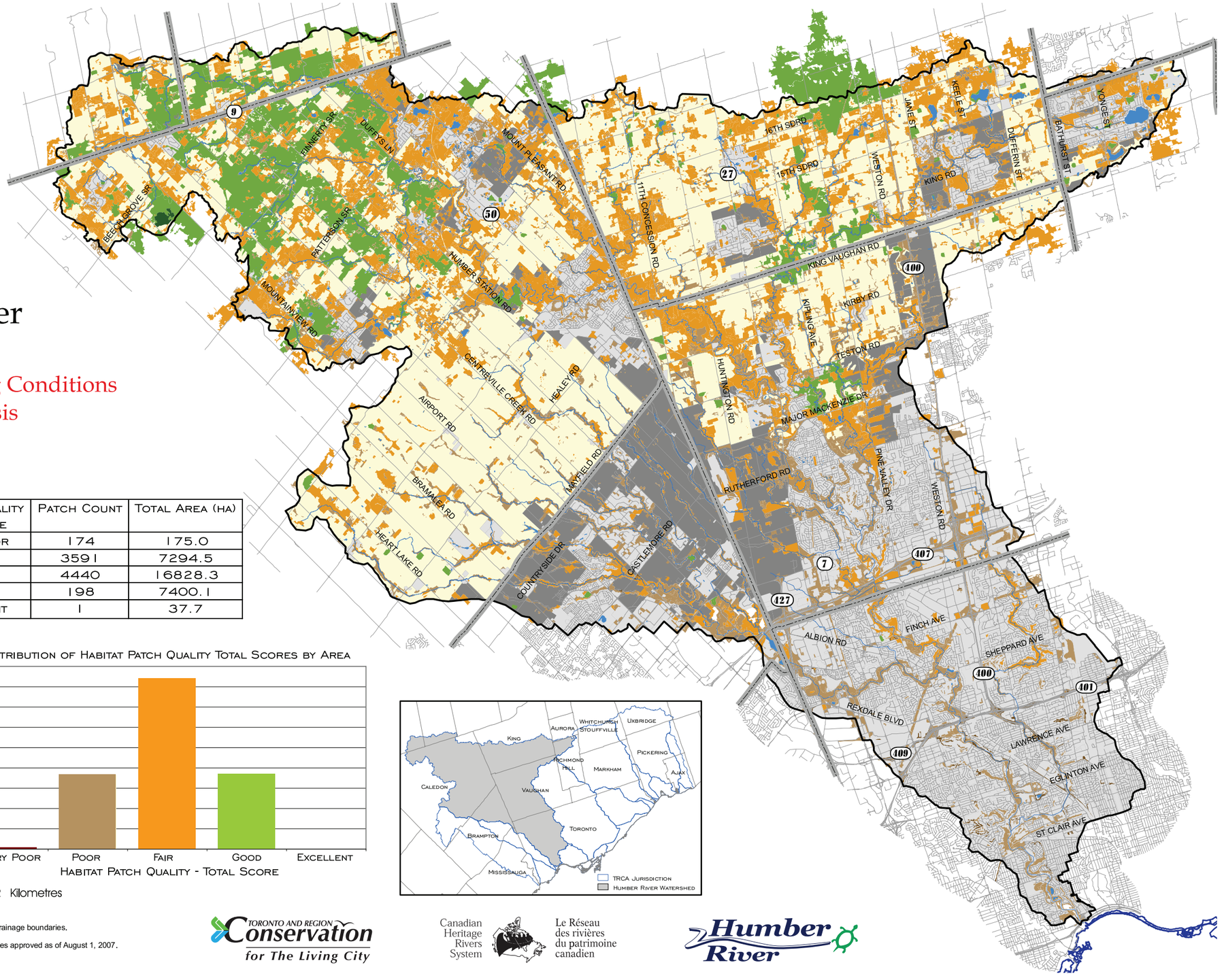
The Humber Marshes comprise one of the few remaining coastal marshes along the north shore of Lake Ontario. The amount of vegetation cover declined significantly during the second half of the 20th century, probably due to high water levels, shoreline alterations and the activity of carp (an introduced species), among other factors. The open water areas are impressive and include sensitive plant species such as fragrant white water lily, lakebank sedge and river bulrush. The vegetation in the Humber Marshes, in combination with Humber Bay Park and High Park, provides extremely important habitat for migrant birds crossing Lake Ontario.

The distribution and quality of natural cover varies widely among subwatersheds (Figure 3–11). The Main and East subwatersheds not only contain the most natural cover but also have the best quality of habitat patches. However, these patches are generally in shapes that leave them

Figure 3–11: Terrestrial natural heritage system quality assessment, 2002

Humber River Watershed

Terrestrial System - Existing Conditions
Landscape Analysis



Legend

- Watershed Boundary*
- Municipal Boundary
- Road
- Pond & Lake
- Watercourse**

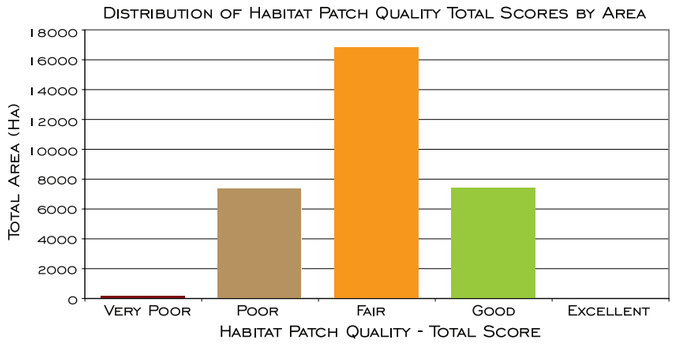
Land Use

- Rural/Agriculture
- Urban
- Urbanizing

Habitat Patch Quality - Total Score

- Very Poor
- Poor
- Fair
- Good
- Excellent

Habitat Quality Total Score	Patch Count	Total Area (ha)
Very poor	174	175.0
Poor	3591	7294.5
Fair	4440	16828.3
Good	198	7400.1
Excellent	1	37.7



0 2 4 8 12 Kilometres

*Watershed boundary has been derived from the Humber River Hydrology Model drainage boundaries.
**Watercourse has been generalized for mapping purposes.
Urbanizing areas based on consolidation of municipal official plan land use schedules approved as of August 1, 2007.

Date: March, 2008
Information Systems/Technology Group

Toronto and Region Conservation for The Living City

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Humber River

vulnerable to external negative influences, or they are not well connected to other natural areas. Unless the system is enhanced, these areas of relatively high quality will probably decline over time and lose many of their current species. In stark contrast, the West, Lower and Black Creek subwatersheds have much less habitat, in small fragmented patches that are mostly in the valley corridors with very little tableland forest.

Well-connected natural areas are generally limited to the Niagara Escarpment and Oak Ridges Moraine portions of the watershed. Further south, the lack of remaining tableland forest means that there is virtually no upland connectivity in the City of Toronto, The City of Brampton and the southern portions of the City of Vaughan and The Town of Caledon. This uneven distribution of good quality habitat has profound effects on the regional natural system. For example, it affects the safety of migrant birds moving through the watershed and the availability of essential habitat to resident species. The fragmentation of habitats also affects the movement of less mobile animals and plants, reducing the long-term viability of populations and decreasing the likelihood that species can return to habitats that have been disturbed.

Another important influence on habitats is the effect of the land uses surrounding them. For example, urban land uses generally exert a high negative influence from changes in hydrology, pollution, refuse dumping, mowing, recreational pressures, invasive species and predation by pets. Dumping of garbage and litter is a widespread problem throughout the watershed and excessive trampling occurs in localized areas, for example, along Cold Creek and the west branch of the West Humber River. On the other hand, agricultural land use exerts a moderate to low negative influence. At present, much of the remaining natural cover in the Humber watershed is located in rural areas and is surrounded by agricultural uses. However, considerable urban growth is expected in the rural areas, except those that are protected by the Niagara Escarpment Plan, the Oak Ridges Moraine Conservation Plan and the Greenbelt Plan. This will inevitably result in increased stresses on the remaining natural areas.

Many of the habitats in the Humber watershed are already infested with invasive, non-native plants, including garlic mustard, European buckthorn and Tartarian honeysuckle in forests; purple loosestrife and common reed grass in wetlands. These aggressive species out-compete native ones, lowering biodiversity and reducing habitat quality for birds and other animals. Invasive insect pests such as the Asian long-horned beetle and emerald ash borer have had devastating effects on natural areas and the urban forest canopy in some parts of the watershed.

In conclusion, the quality, distribution and quantity of natural cover in the Humber watershed continues to decline due to the impacts of human activities and the continued conversion to other land uses, despite significant reforestation efforts in recent decades. Numerous

ASIAN LONG-HORNED BEETLE

This large beetle (adults range from 2.5–4 cm in length) was accidentally transported to Canada from China in wooden packing crates. It infests and kills a large variety of hardwood trees with potentially devastating effects on both the urban tree canopy and native woodlands. In 2003 it was found on the border between Toronto and Vaughan and 17,000 trees had been cut down by March 2004 to prevent it from spreading. Over 37,800 replacement trees, saplings, seedlings and shrubs have been planted, but it will take decades of growth to replace the many mature trees that were lost.

Photo used with permission from the Canadian Food Inspection Agency

sensitive species and communities have disappeared and many that have persisted are in decline. If the current terrestrial system is expanded, it may be possible to reverse this trend and support viable populations of native species and communities over the long term.

Key Issues

- Limited amount and quality of natural cover
- Existing natural cover patches are poorly connected, especially in the east-west directions
- Distribution of natural cover is weighted to the northern portions of the watershed
- Invasive species threaten native ecosystems
- Impacts of human activities on plants, animals and their habitats

3.3 SOCIETY

3.3.1 CULTURAL HERITAGE

Pipe end

The earliest settlers in the Humber watershed were the Paleo-Indians who lived in the tundra-like area from 10,000 to 7,000 BC and survived mainly by hunting large game such as caribou. In the warmer conditions of the Archaic Period (7,000 to 1,000 BC), First Nations people adopted seasonal migration patterns to take advantage of available resources. They gathered plants and fish at the river mouths in spring and summer, and hunted game in more sheltered upland areas during fall and winter. In the Initial Woodland Period from 1,000 BC to 600 AD, populations became larger, lived in more permanent camps and villages, and began to grow crops such as corn, beans and squash. The Toronto Carrying Place Trail in the Humber watershed became an important north-south linkage from Lake Ontario to Lake Simcoe.

Étienne Brûlé was the first European to travel the Toronto Carrying Place Trail, passing through the Humber watershed in 1615. Fur trading with the Senecas was a major source of income for the early French, English and Dutch traders. Settlement by Europeans began in earnest in the 19th century and villages provided services such as general stores, churches, blacksmiths, schools, distilleries, mills and wagonwrights. However, by the 1860s, sawmills had been put out of business by widespread tree-cutting and many villages declined or even disappeared. Agricultural activities continued to support a relatively low population density until the 20th century, when the influences of the growing City of Toronto began to expand into the watershed. Since the 1920s, development in the Humber watershed has moved steadily outward from the City of Toronto, progressing from the suburbs of the City of Etobicoke and the City of North York to the City of Mississauga, The City of Brampton and Woodbridge.

Historically, most of the European settlers in the Humber watershed were of British descent, as reflected during such annual events as the Binder Twine Festival in the Village of Kleinburg and the Bolton Fall Fair. In the past 25 years, watershed communities have become increasingly multi-cultural. The 2001 Canadian census showed that people who identify themselves as being of Italian origin represent the largest group in the watershed with nearly 20 per cent of the resident population, followed by Canadian (11 per cent), English (nine per cent), East Indian (seven per cent),

Scottish (five per cent) and Irish (five per cent). The country of origin of recent immigrants (those who came to Canada between 1996 and 2001) was India (17 per cent), Jamaica (six per cent), Pakistan (six per cent) and Guyana (five per cent), with the remaining new immigrants coming from over 35 different countries.

The rich human heritage values of the Humber watershed are illustrated by over 1,800 known archaeological and heritage sites as well as numerous historical accounts. While they can be found throughout the watershed, some areas are worth highlighting, either because they are the locations of particularly noteworthy individual features, or because they contain many features which together provide a unique experience. Figure 3–12 illustrates these cultural heritage highlights. They range from settlements near the mouth of the river to Black Creek Pioneer Village, the historic Carrying Place Trail and native village sites with ossuaries.

Municipalities have made good progress in documenting the cultural heritage of the watershed, with the identification of 1,401 architectural resources or built heritage structures in the watershed. Most notable is the recent establishment of online searchable databases and interactive maps by the City of Toronto, the City of Vaughan and the Town of Aurora. However, municipalities in the watershed use a variety of methods to define and record heritage resources and some have more capacity to maintain inventories than others.

Less progress has been made towards protection of heritage resources, with only 86 heritage sites currently designated for protection under the *Ontario Heritage Act*, and 35 heritage features demolished since 2000. Recent amendments to the *Ontario Heritage Act* will assist in the identification and protection of heritage resources in the future. Funding for preservation and continued use of cultural heritage sites and buildings in public ownership remains a challenge. There is also no suitable repository for archaeological artifacts in the watershed.

McVean Barn

Inside the McVean Barn

The Toronto Carrying Place trail.
Photography by Dean Young

Lambton House, a designated heritage building in Toronto.
Photography by Dean Young

The designation of the Humber as a Canadian Heritage River in 1999 recognized its outstanding human heritage and recreation values and the contribution it has made to the development of Canada. Nevertheless, more effort is needed to increase public knowledge of past and present human cultures as well as the historical significance of the Humber River to the economic prosperity and character of the country.

Contemporary culture is reflected in many communities through their public facilities, gardens, art and a wide range of activities and programs. For example, the watershed has seven museums, 13 art galleries and 40 libraries as well as numerous architectural landmarks, community centres, cultural and religious venues, fairgrounds, theatres, interpretive trails, sculptures and murals. Many new Canadians celebrate their cultural heritage and continue to practise traditions from their home countries. They are often keen to learn about Canadian heritage by visiting local tourist destinations and open spaces, volunteering in events and participating in new recreational activities. The ever-changing human culture in the watershed enriches the lives of its residents. It also presents opportunities to offer educational programs for both newcomers and lifetime residents that will help to foster awareness of the natural environment, encourage civic pride, bring people together and increase stewardship of the watershed's cultural and natural heritage.

Key issues

- Rich cultural heritage with the potential to lose many more heritage sites and landscapes
- Inconsistent and often limited information available about heritage resources
- Lack of suitable repository for archaeological artifacts and documents
- Limited public awareness of both the historical and current relationships between people and the watershed
- Need to adapt cultural heritage programs to meet the needs and interests of the watershed's multicultural communities

3.3.2 NATURE BASED RECREATION

2007 Report Card

- How much publicly owned greenspace is there?

Rating: B

- How extensive are outdoor recreation opportunities?

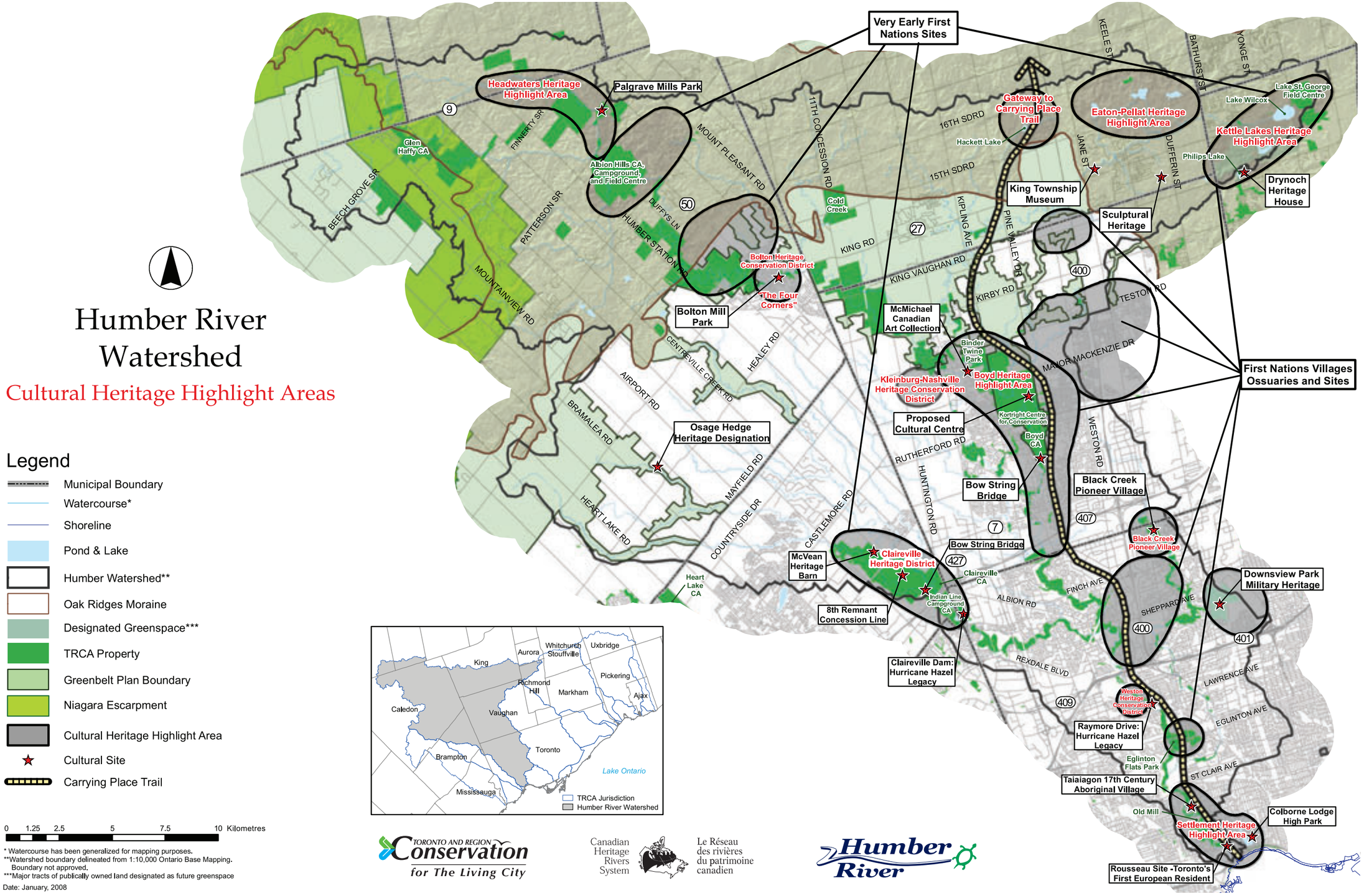
Rating: C

- What progress has been made in developing a system of inter-regional trails?

Rating: A

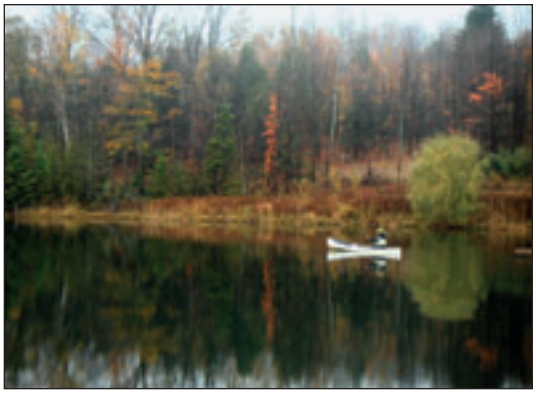
Nature-based recreation includes all outdoor public recreation activities that depend on healthy, attractive, natural landscapes. They include walking, hiking, cross-country skiing, wildlife viewing, picnicking, camping, bicycling, horseback riding, canoeing, fishing and swimming. The plan focuses on regional scale nature-based recreation facilities and opportunities (including large municipal parks). While these activities depend on natural and rural resources, if not properly managed they can result in negative impacts on natural or cultural heritage values of the watershed. Ongoing urbanization and population growth may create challenges for sustainable management of public lands because of the increasing number of people using them. Some current problems include unauthorized trails, incompatible uses in greenspace areas (e.g., construction and off-road vehicles), litter, dumping and other encroachments. Many conservation areas, parks and associated buildings, trails and other infrastructure are showing signs of decline and are in need of refurbishment. However, current funding sources are often inadequate to support ongoing maintenance or further development of the nature-based recreation system.

Figure 3–12: Cultural heritage highlight areas



The system of conservation areas, parks and trails provides opportunities for nature-based recreation activities and distinctive experiences of the natural and cultural heritage of the Humber watershed. As illustrated in Figure 3–13 and described in Table 3–1, these destinations can be grouped into concept areas as follows, based on the types of experiences they offer:

- Kettle lakes
- Hills of the headwaters
- Humber valley wilderness
- Urban escape
- Black Creek parklands
- Humber Bay parklands



Canoeing at Albion Hills.
Photography by Jeff Hladun

Granger Greenway inter-regional trail near the Kortright Centre in Vaughan.
Photography by Lou Wise

Approximately 10 per cent of the Humber watershed, or 8,655 hectares, is publicly-owned greenspace (representing all municipal parks and public conservation lands including valley and stream corridors but excluding golf courses, cemeteries and fairgrounds). Most of this greenspace (6,644 hectares) is owned by the TRCA, primarily along the Humber River and its tributaries. In total, there are 198 municipal parks and conservation areas in the watershed.

The Lower Humber subwatershed is the best endowed with greenspace, as it represents 16 per cent of the area of the subwatershed. The Main Humber has 11 per cent greenspace, and Black Creek has 10 per cent. The West and East Humber have the least amount of greenspace, 7 per cent and 6 per cent respectively, due in part to the limited extent of urban settlements in these subwatersheds.

In addition to the greenspace noted in Table 3–1, there are 24 golf courses in the watershed, including eight private, one semi-private and fifteen public facilities. Five of these courses (Diamond Back Golf Club and Bathurst Glen Golf Course in the Town of Richmond Hill, Nobleton Lakes Golf Club in the Township of King, and Oakdale Golf and Country Club and the Toronto Board of Trade Golf Course in the City of Toronto) participate in the Audubon Cooperative Sanctuary Program to help conserve resources, protect the environment and maintain healthy wildlife habitats.

The Humber watershed has a number of inter-regional trail systems, with a total of about 213 kilometres of trails (see Figure 3–13). No official trail yet exists along the full length of the historic Carrying Place Trail. However, the Humber Trail, up to Major Mackenzie Drive, generally follows the portage route that First Nations peoples, explorers and traders would have taken to travel between Lake Ontario and Lake Simcoe. There are also many local trails, totalling 123 kilometres, in most of the watershed municipalities. Trails are clearly seen as providing important public recreational opportunities at both the regional and local levels. They grew by 28 kilometres between 2000 and 2004. An additional 60 kilometres of inter-regional trails and 168 kilometres of local trails are proposed. This will increase opportunities for nature-based recreation and address many of the current gaps in the trail network.

Table 3–1: Humber River watershed nature-based recreation destinations and experiences

Concept Area	Destinations	Experiences
Kettle Lakes	• Lake St. George Field Centre • Lake Wilcox • Oak Ridges Corridor Park • Oak Ridges Moraine	• Kettle lakes • Nature interpretation • Passive use • Outdoor education programs • Golf • Unique landforms • Scenic views • Connection to Don River and Rouge River watersheds
Humber Bay Parklands	• High Park • Lake Ontario Waterfront • Waterfront Trail • Parklands	• Urban escape • Water activities (e.g., swimming, boating and fishing) • Trails
Urban Escape	• Claireville Conservation Area • Claireville Ranch • Wild Water Kingdom • Indian Line Campground • Humber Arboretum	• Water management interpretation • Equestrian • Water play • Camping • Swimming • Fishing • Nature interpretation • Trails
Black Creek Parklands	• Black Creek Pioneer Village • Parklands • Urban Farm	• Cultural heritage interpretation • Events space and festivals • Trails • Urban agriculture
Humber Valley Wilderness	• Living City Campus at Kortright • Boyd Conservation Area • McMichael Canadian Art Collection • Granger Greenway • Humber Valley Heritage Trail • Pierre and Janet Berton Trail	• Aboriginal heritage interpretation • Education • Picnicking • Visual arts • Trails
Hills of the Headwaters	• Palgrave Trail Hub • Conservation Areas (Albion Hills, Glen Haffy) • Albion Hills Field Centre • Inter-regional trails (Bruce Trail, Oak Ridges Trail, Great Pine Ridge Trail, Humber Valley Heritage Trail) • Oak Ridges Moraine • Niagara Escarpment	• Active use (camping, mountain biking, swimming, boating, fishing and golf) • Trails (pedestrian, equestrian, cycling, cross-country skiing and multi-use) • Outdoor education programs • Unique landforms • Scenic views • Connection to Credit River watershed

Figure 3–13: Nature-based recreation areas and experiences

Humber River Watershed

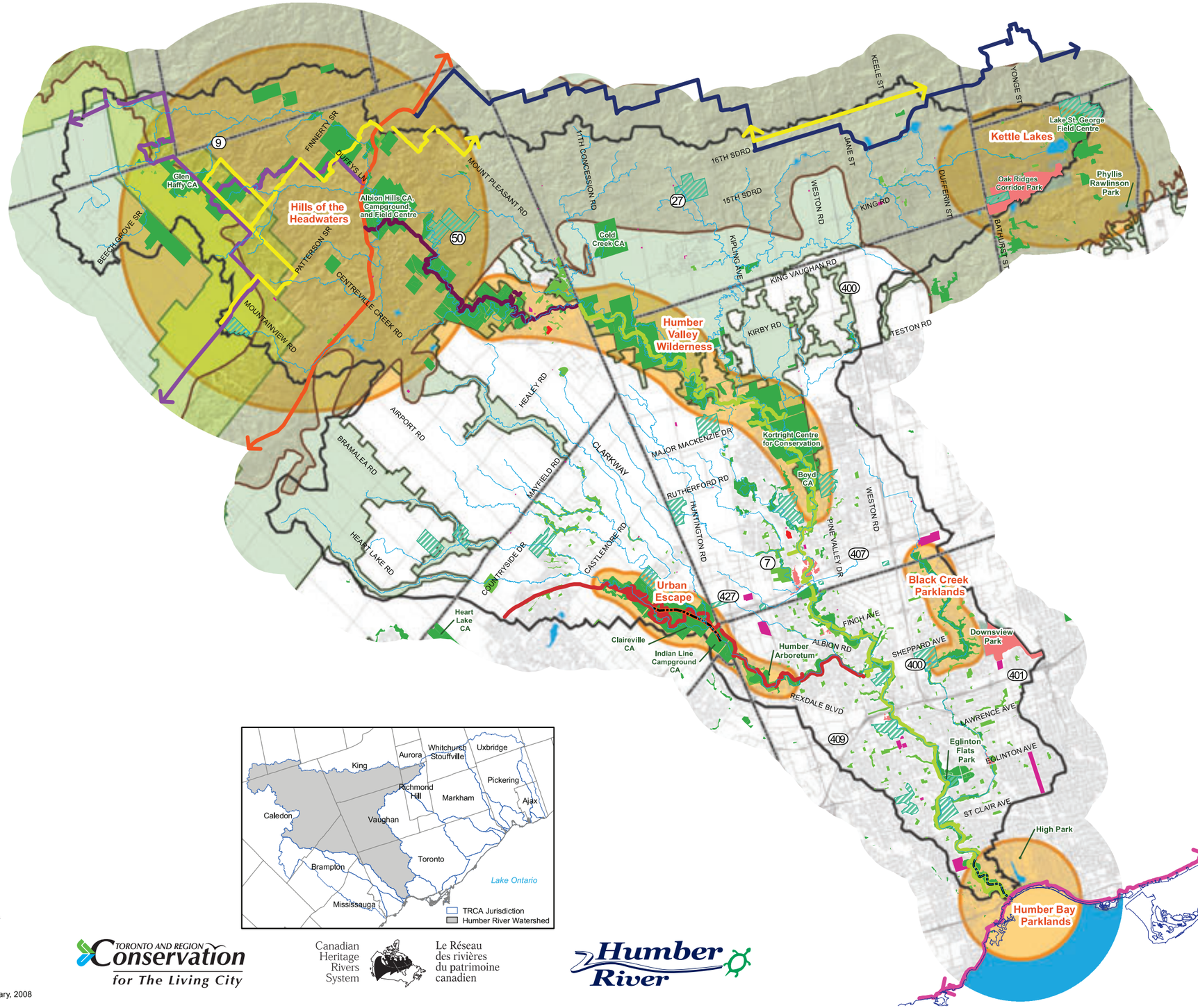
Nature Based Recreation Areas and Experiences

Legend

- Municipal Boundary
- Watercourse*
- Shoreline
- Pond & Lake
- Humber Watershed**
- Oak Ridges Moraine
- Designated Greenspace***
- TRCA Property
- Greenbelt Plan Boundary
- Niagara Escarpment
- Public Use Theme
- Bruce Trail
- Humber Trail
- Great Pine Ridge Trail
- Humber Valley Heritage Trail
- Oak Ridges Trail
- Trans Canada Trail
- West Humber Trail
- Waterfront Trail
- Claireville Canoe Route
- Humber Bay Canoe Route
- Golf Course
- Fairground
- Cemetary
- Provincial/Federal Property
- Municipally Owned Parks

0 1 2 4 6 8 10 Kilometres

* Watercourse has been generalized for mapping purposes.
**Watershed boundary delineated from 1:10,000 Ontario Base Mapping. Boundary not approved.
***Major tract of publically owned land designated as future greenspace
Produced by Toronto and Region Conservation Authority under Licence with the Ministry of Natural Resources © Queen's Printer for Ontario. January, 2008



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Humber River

There are many popular recreational angling destinations in the watershed, including Albion Hills, Claireville, and Glen Haffy Conservation Areas, Bolton Resources Management Tract, Lake Wilcox, the Humber Marshes, the Lower Humber River and the Eglinton Flats. The Ontario Ministry of Natural Resources stocks the Humber River with brown and rainbow trout, as well as chinook, coho and some Atlantic salmon. However, there is little understanding of the impacts of stocking, recreational use and harvesting of fish on native, naturally-reproducing fish populations in the watershed.

Fishing at Glen Haffy extension ponds.

Boating has always been part of life on the Humber River. Today, canoeists paddle the Lower Humber from the Humber Marshes to the Old Mill, and can paddle the West Humber River for about three kilometres upstream of the Claireville Reservoir. Competitive paddlers train at Lake Wilcox and Humber Bay is used extensively by paddlers, rowers and sailors.

Fishing at Glen Haffy extension ponds.

The nature-based recreation facilities in the watershed support the local economy and contribute to community and family life by providing opportunities to alleviate stress and promote good health. It is likely that there will be growing demand for access to greenspace due to the increasing popularity of outdoor recreation activities (such as hiking, bird watching and environmental education), the expected population growth in the Greater Toronto Area, and the increasing numbers of retired people with more time available for recreation. It will be important to increase the supply of greenspace, especially in areas such as the West and East Humber subwatersheds that currently have a limited supply of public lands. This will help to meet growing demands, accommodate the needs of new Canadians and ensure that the use of existing parks, conservation areas and trails is consistent with the protection of environmental and natural heritage values.

Key issues

- Potential for negative impacts on natural and cultural values of nature-based recreation destinations from increasing use
- Inadequate funding to support maintenance or further development of the greenspace system
- Limited availability of public greenspace in some areas
- Gaps in the trail systems
- Limited understanding of existing levels of use and "carrying capacity" of nature-based recreation destinations

3.4 ECONOMY

3.4.1 LAND USE

2007 Report Card

- How well is agricultural land being conserved?

Rating: D

- How well are people doing at using resources wisely and living a sustainable lifestyle?

Rating: C

Overview

Approximately 27 per cent of the watershed is in urban land use, with 40 per cent in rural use and 32 per cent under natural cover (Figure 3–2) The greatest concentration of urban land use is in the southern portions of the watershed, with urbanizing areas in the middle (north of Steeles Avenue) and predominantly agricultural lands in the north (Figure 3–14).

Population growth in the watershed has been rapid in recent decades. In the six years between 1995 and 2001 the population grew by 37 per cent to 670,000 and is continuing to increase in all of the watershed municipalities.

Urban Areas

The densely populated lower portion of the watershed, mostly in the City of Toronto, includes low, medium and high density residential, commercial, industrial and institutional uses. Land use change is relatively slow, and focuses primarily on redevelopment and infill projects. Where long-established urban uses are adjacent to valley and stream corridors (that is, pre-dating TRCA's Valley and Stream Corridor Management Program), they are typically built to the top of bank, or even encroach into the valley. This has resulted in considerable losses of natural cover as well as changes to valley landforms through historical cutting, filling and installation of retaining walls. The City of Toronto's current Official Plan requires much more consideration of environmental protection than in the past. This will result in greater setbacks from natural areas, restoration of degraded natural areas, consideration of natural stream form, separation of combined sewers and improved stormwater management through redevelopment.

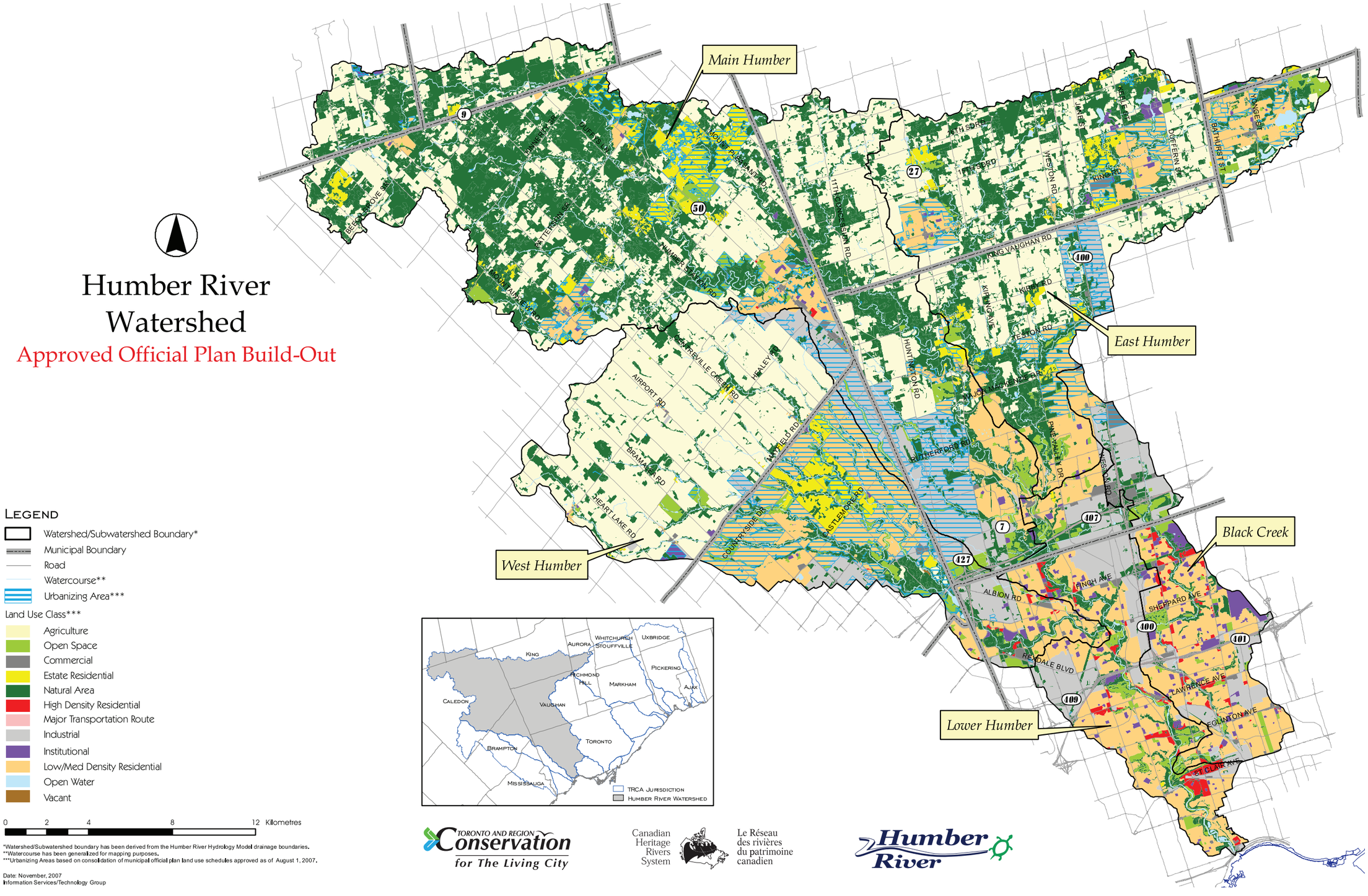
The system of storm and sanitary sewers in the older urban areas presents issues for watershed health. Many storm sewer outfalls discharge directly to watercourses, with no provisions to control pollutants or diffuse high velocity flows. As mentioned in Section 3.2.5, portions of Black Creek and Lower Humber subwatersheds in the City of Toronto are serviced by combined sewers, a cause of surface water contamination during large storms.

As discussed in Section 3.2.4, some locations that are designated for urban intensification are in flood vulnerable areas. Some of these are designated Special Policy Areas and will require measures to manage flood risks (Figure 3–15).

Key Issues

- Lack of natural cover
- Encroachments on valley landforms and public land
- Older systems of stormwater management result in water pollution and extreme flows
- Urban intensification proposed for flood prone areas

Figure 3–14: Approved official plan land use



Urbanizing areas

Urban growth in the West Humber subwatershed.
Photography by Lou Wise

The middle, urbanizing portions of the watershed include the West Humber, East Humber and lower reaches of the Main Humber subwatersheds. They extend northwest from Steeles Avenue, to the upper portions of the cities of Vaughan and Brampton, northeast to the towns of Richmond Hill and Aurora, and include pockets of the Town of Caledon and Township of King (Figure 1–2). These areas have experienced very high rates of urban growth over the last two decades, primarily in the form of single family residences built at low densities that do not support the development of rapid public transit services. In addition, the City of Vaughan and The City of Brampton have the largest inventories of industrial and commercial land in the Greater Toronto Area. The Highway 400 and 427 corridors have traditionally been a major focus for industry, but new industrial development is now occurring along Highway 50 and Airport Road.

Bond Lake within Oak Ridges Corridor Park in Richmond Hill
Photography by Lou Wise

The North Urban Development Area in the Town of Richmond Hill was designated for a mixture of residential and commercial uses under OPA 129 in 1995, and has experienced rapid development of large scale, low density developments since that time. In the South Urban Development Area, several privately-initiated applications for urban development precipitated an Ontario Municipal Board hearing in 2000. Development in this area would have severed the Oak Ridges Moraine at the Yonge Street Corridor. Instead, an exchange was negotiated between the landowners of the corridor lands and provincial landholdings in Pickering. This enabled the creation of the Oak Ridges Corridor Park in Richmond Hill to provide long term protection and restoration of natural linkages between the west and east sections of the Oak Ridges Moraine.

Lands in the urbanizing area have little natural cover due to a long history of agricultural land uses. Remaining natural cover is generally restricted to valley and stream corridors, where soils were too wet for farming, and woodlots that have been maintained for timber supply. Many of the small watercourses and wetlands in the upper part of the watershed have been altered, stripped of natural vegetation or drained.

As noted in Section 3.2.3, impervious surfaces associated with urban land uses alter the water balance and change stream flow patterns. This results in impacts on groundwater recharge and discharge, channel and stream bank stability, water quality and aquatic habitats.

Site preparation for development on large greenfield sites typically entails stripping of topsoil. Often this is undertaken long before construction commences, leaving substantial amounts of land vulnerable to erosion by wind and rain and creating problems of sedimentation in streams and other natural features. Until recently, most developments have included narrow buffers or no buffers to protect valleylands and other natural features from encroachment and disturbance.

In an effort to cope with the pace of urban development, some municipalities are now focusing on growth management. For example, since 2004, the City of Brampton has limited the number of building permits to a maximum of 5,500 units per year. Provincial and municipal growth strategies also emphasize intensification, infill development and a process of block planning that provides a more comprehensive approach to sustainable community development.

Key Issues

- Changes to water balance due to an increase in impervious surfaces
- Topsoil stripping, erosion and sediment from construction
- Inconsistent application of buffers between developments and natural features

Rural areas

Agricultural land adjacent to a new urban settlement.
Photography by Lou Wise

The rural area of the Humber watershed begins at the northern edges of the cities of Brampton and Vaughan, and encompasses the southern portion of the Township of King, the eastern portion of the Town of Caledon, and small parts of the Town of Mono and the Township of Adjala-Tosorontio. It is generally situated in the northernmost headwater areas of the Main, West and East Humber subwatersheds. It includes agricultural land uses, rural towns and villages, low density estate residential areas and large tracts of natural land cover (forest, meadows and wetlands). Most of these lands are subject to the policies of the Niagara Escarpment Plan, the Oak Ridges Moraine Conservation Plan and the Greenbelt Plan (see Figure 3-15). As a result, about 45 per cent of the Humber watershed is protected from urban development.

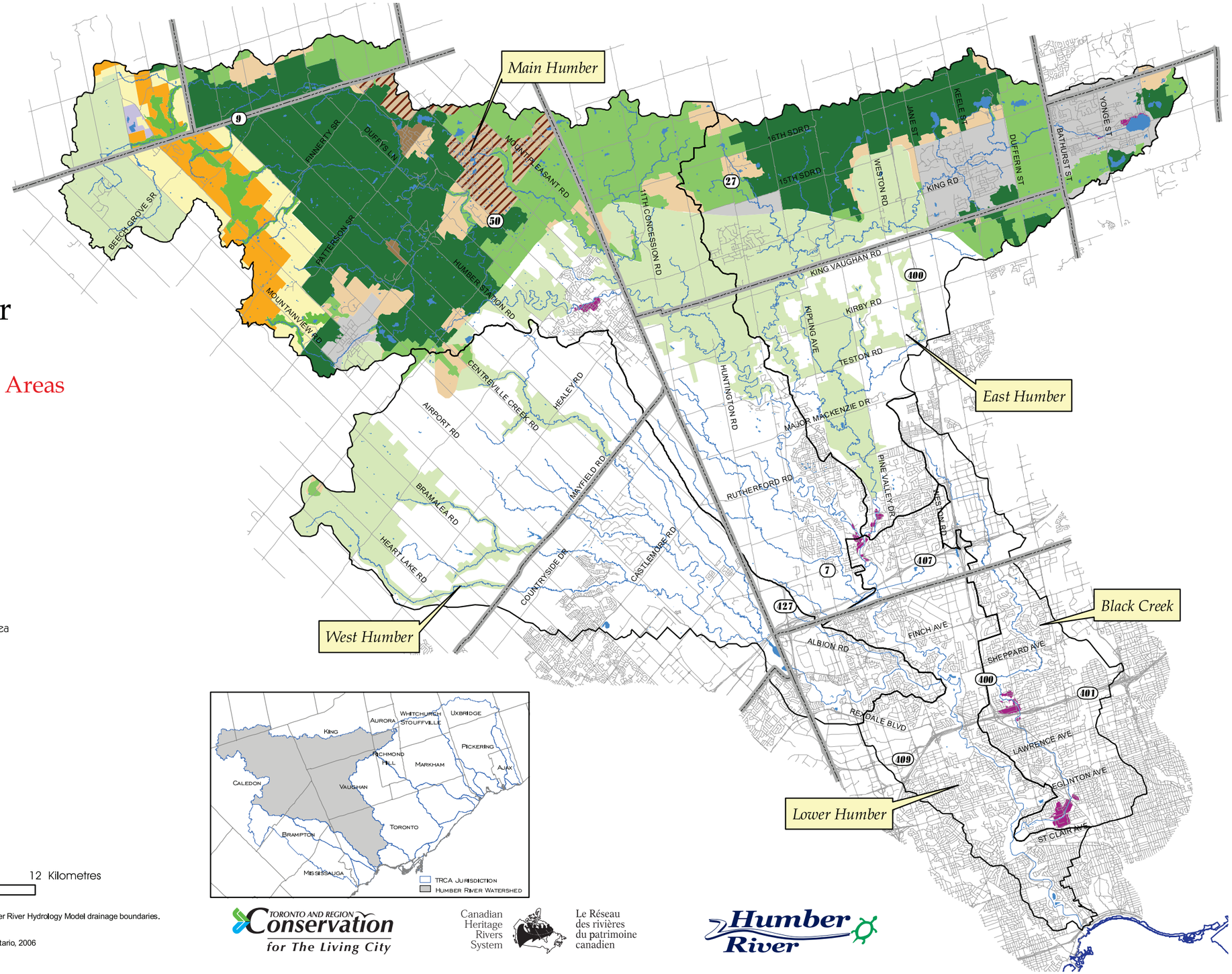
The agricultural lands are predominantly used to raise livestock (dairy, beef, poultry and horses) and crops (fruit, vegetable, grain, sod, tree nursery and greenhouse products). The viability of agriculture in the rural areas is affected by development in the urbanizing areas of the watershed in several ways, including the loss of large contiguous tracts of land for crops.

Agriculture in the Humber watershed faces similar challenges to the rest of the Greater Toronto Area. Urban markets have become increasingly dependent on imported, rather than local, sources of food. Farming operations frequently come into conflict with urban land uses in close proximity. Net annual revenues are inadequate to support farm families, ranging from $20,000 to $25,000 per farm in the Regional Municipality of Peel, the Regional Municipality of York and the Regional Municipality of Durham (based on 2001 Statistics Canada data). Increasingly, farms need larger areas and more technology to be economically viable. But farm operating costs per acre are increasing and are higher than in other parts of the province, for a number of reasons. These include high land values (due to urban development speculation), loss of local agricultural services, high taxes, and the costs of compliance with recent regulations such as the *Nutrient Management Act*. Because of these economic challenges, most farmers cannot afford to invest in measures that could increase their returns such as land acquisition or new agricultural ventures to serve the urban market. Other opportunities to contribute to a healthy countryside, such as Environmental Farm Plans, cultural heritage protection and natural heritage stewardship are also frequently beyond their reach.

Figure 3–15: Special land use policy areas

Humber River Watershed

Special Land Use Policy Areas



Legend

- Watershed/Subwatershed Boundary*
- Municipal Boundary
- Road
- Pond & Lake
- Watercourse**
- Special Policy Area***
- Greenbelt Plan Protected Countryside Area

Niagara Escarpment Plan

- Escarpment Natural Area
- Escarpment Protection Area
- Escarpment Rural Area
- Mineral Resource Extraction Area

Oak Ridges Moraine Conservation Plan

- Countryside Area
- Natural Core Area
- Natural Linkage Area
- Palgrave Estates Residential Community
- Rural Settlement
- Settlement Area

0 2 4 8 12 Kilometres

*Watershed/Subwatershed boundary has been derived from the Humber River Hydrology Model drainage boundaries.
**Watercourse has been generalized for mapping purposes.
***Under section 3 of the Provincial Policy Statement.
Roads, Greenbelt, NEC, and ORM boundary © Queen's Printer for Ontario, 2006

Date: January, 2006

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Humber River

Some smaller farms are beginning to adapt to these challenges by shifting to organic production systems and growing new, specialty crops that cater to urban markets and changing cultural demographics.

There are also valuable aggregate resource areas in the watershed, primarily in the Town of Caledon. The Town's Official Plan Amendment 161 provides policies intended to ensure that aggregates are extracted in an environmentally sensitive way, and that exhausted pits and quarries are rehabilitated to uses compatible with agriculture, other rural uses or greenspace.

Key Issues

- Declining availability of large contiguous parcels of prime land for traditional forms of agriculture
- Poor economic viability of traditional agricultural industry
- Conflicts between farming and adjacent land uses
- Slow uptake of non-traditional crops and agricultural systems

Transportation

The transportation infrastructure in the Humber watershed includes major highways (400, 401, 407 and 427), GO Transit, the Toronto Transit Commission (TTC) and other municipal bus systems. Pressure exists for new and expanded roads to relieve traffic congestion and several environmental assessments are currently underway.

Finch Avenue being washed out by Black Creek during a major storm event on August 19, 2005. Photography by Tahir Rasul

Numerous watercourse crossings have been constructed to support transportation infrastructure with insufficient consideration to environmental protection. This has resulted in a number of impacts, including narrow openings that do not accommodate regional storm flood flows, pedestrian movement, wildlife passage or the natural meander belt of the stream. Such under-sized crossings tend to be damaged by flooding or erosion, which has typically been addressed by hardening the stream bed and banks, creating further impacts on natural habitats and considerable economic costs. Significant improvements are now being made in the design of new watercourse crossings, thanks to the greater attention given to environmental issues in the land use planning process.

The City of Toronto portion of the Humber watershed has a well developed public transit system provided by the TTC and GO Transit. There are plans for improvements to meet the needs of future population and employment growth, including a subway extension to York University and Vaughan Corporate Centre, and GO train service from downtown to Pearson International Airport.

The predominant land use patterns in the urbanizing lands are low density, resulting in population densities that are much less supportive of public transit. Nevertheless, various initiatives are underway to increase transit use, including the City of Brampton's "AcceleRide" program and the Regional Municipality of York's VIVA Rapid Transit system. In addition, York recently endorsed guidelines for a regional transit-oriented development strategy.

According to the 2001 Canadian Census, nearly 85% of Regional Municipality of Peel residents used a car, truck or van to get to work and only 12% used public transit. Reliance on the automobile was less in the City of Toronto, where 52% of residents drove to work, and 33% used public transit. The predominance of automobile use contributes to traffic congestion, poor air quality, greenhouse gas emissions, water pollution and large expanses of impervious surfaces associated with roads, driveways and parking areas.

Key Issues

- Environmental impacts associated with poorly-designed watercourse crossings
- Development patterns and population densities that do not support public transit
- Traffic congestion, vehicle emissions and impervious surfaces (resulting in more runoff and pollutants)

3.4.2 RESOURCE USE

Water supply and wastewater

Water supplies to communities in the Humber watershed come from two sources: Lake Ontario and underground aquifers. The City of Toronto's water treatment facilities on Lake Ontario provide treated potable water from the lake to the residents and businesses of the City of Toronto as well as urbanized areas of the City of Vaughan and the Town of Richmond Hill. The South Peel Water System, also based on Lake Ontario, supplies water not only within the Regional Municipality of Peel but also to parts of the City of Vaughan, the Town of Richmond Hill and the Town of Aurora.

A number of communities in the Humber watershed – Caledon East, Palgrave, the Village of Kleinburg, the Village of Nobleton and the Village of King City – depend on groundwater from municipal wells. The remaining rural areas rely on groundwater from private wells.

The Regional Municipality of York is conducting an environmental assessment process to address the need for expansions to well-based water supply systems to accommodate the growing communities of the Village of Kleinburg, the Village of Nobleton and the Village of King City. Similarly, the Regional Municipality of Peel is undertaking an environmental assessment study regarding opportunities to expand the well-based water supply for Caledon East, including consideration of any potential environmental impacts from groundwater pumping.

The City of Toronto and the Regional Municipality of Peel operate wastewater treatment plants on the shores of Lake Ontario. In the Regional Municipality of York, the urban areas of the Town of Richmond Hill, the City of Vaughan, the Village of King City and the Town of Aurora are serviced by the York Durham Sewage System, which transports wastewater for treatment at the Duffins Creek Treatment Plant in the City of Pickering. Wastewater in the Village of Kleinburg is treated at a sewage treatment plant and discharged to the main channel of the Humber River. The Regional Municipality of York is currently conducting an environmental assessment to address the need for expansion of this plant. The Village of Nobleton, in the Township of King, has an approved environmental assessment to service existing and new development with a sewage treatment system that will outlet to the Main Humber River. In the rural portions of the Humber watershed, private septic tile bed systems are operated by individual landowners.

Canada ranks 28th among 29 nations of the Organization for Economic Cooperation and Development (OECD) for per capita water use, with only Americans consuming more water. Rates of residential water demand in the GTA are below the Canadian average of 325 litres/day/person. In 2004 they ranged, in the Humber Watershed, from 213 litres/day/person in the Town of Caledon to 248 litres/day/person in the City of Mississauga. In order to reduce the economic and environmental costs associated with supplying potable water and treating wastewater, the City of Toronto, the Regional Municipality of York and the Regional Municipality of Peel have prepared water efficiency plans that include water audits, conservation incentives, public education, leak detection and repair programs.

Key Issues

- High water consumption rates
- Need to protect sources of drinking water from potential sources of contamination or reductions in availability

Solid waste

Since the closure of the Keele Valley Landfill Site in the City of Vaughan, residual waste from the City of Toronto and the Regional Municipality of York is transported to landfill sites outside the Greater Toronto Area. The City of Toronto has recently purchased a disposal site in the City of St. Thomas, Ontario. To reduce the costs of sending wastes out of the Greater Toronto Area, municipalities are working to increase their waste diversion rates including reuse, recycling, incineration and composting programs.

The City of Toronto diverted 40 per cent of residential waste in 2005 and plans to increase diversion to 100 per cent by 2010. Also, it is seeking additional locations for facilities to treat organic wastes from the "Green Bin" program. One of the ten potential locations is in the Humber watershed (the Ingram Transfer Station).

The Regional Municipality of York's waste diversion rose from 24 per cent in 2004 to 35 per cent in 2005. A recent Durham-York Residual Waste Study (2006) recommended 60 to 75 per cent diversion of wastes with thermal treatment of the remaining wastes and recovery of materials from the ash.

In the Regional Municipality of Peel, approximately 45 per cent of waste produced in 2004 was diverted into recycling, reuse or composting. The Region's target is to divert 70 per cent of waste by 2016. The remaining waste is incinerated at the KMS Peel Energy-from-Waste facility in the City of Brampton, or received at the Town of Caledon Sanitary Landfill, and the ash is exported to Michigan for landfill. A new "Alternative Fuel from Waste" facility is being installed at the Town of Caledon Sanitary Landfill.

Key Issues

- Economic costs, air pollution and greenhouse gas emissions associated with transport of solid waste out of the region
- Need to reduce waste generation and increase reuse and recycling

CHAPTER

4

4.0 FUTURE ENVIRONMENTAL CONDITIONS

The Humber watershed will experience major changes in land use over the next few decades. Approved official plans allow for an additional 8,845 hectares of new urban lands beyond 2002 land uses, increasing the amount of the watershed that is urbanized from 27 per cent to 36 per cent. Once these plans are implemented, there will probably be further development in some watershed municipalities up to the boundaries of the *Greenbelt Plan* and *Oak Ridges Moraine Plan* protected areas, assuming these policies are maintained (Figure 3–15). Although this legislation will be subject to review in 2014 and 2015, the scientific foundation of this watershed plan provides the Province of Ontario with strong support for the continued protection of these areas.

The Humber watershed offers unique opportunities, including the protection of natural lands in the Niagara Escarpment and Oak Ridges Moraine and the continuation of agriculture on public and private lands in the Greenbelt. Municipalities in the watershed are already working to address the negative impacts of existing developments and are among the leaders in promoting sustainable practices. These opportunities provide valuable tools to help address concerns with current watershed conditions, avoid negative impacts from future land use changes and adapt to the uncertainties associated with global climate change.

To help develop an understanding of how the watershed might react to changes in land use and environmental management in the future, nine potential future scenarios were developed, analyzed

Models used to evaluate the scenarios

PRMS – water budget, recharge
MODFLOW – groundwater levels, discharge
HSP-F – surface water flow and quality
LSAT – aquatic communities and species
Landscape Analysis Model – quality of terrestrial habitats.

For more information, see *Humber River Watershed Scenario Modelling and Analysis Report*, TRCA, 2008a.

Summary of scenarios

1. Current conditions (2002)
2. Approved official plan build-out with conventional approaches
3. Approved official plan build-out with stormwater retrofits
4. Approved official plan build-out with expanded natural cover
5. Full build-out with conventional approaches

5A. Full build-out with conventional approaches and warmer and wetter climate

5B. Full build-out with conventional approaches and warmer and much wetter climate

6. Sustainable communities

6A. Sustainable communities with warmer and wetter climate

6B. Sustainable communities with warmer and much wetter climate

(also see Appendix D)

and examined in relation to existing conditions (Appendix D). This enabled comparisons of the impacts of different land use and management scenarios on watershed conditions and assessment of the relative effectiveness of management approaches.

The land use scenarios included existing (2002) land uses, build-out of approved official plans, and full build-out of all the lands in the watershed not protected by the Greenbelt, Oak Ridges Moraine, and Niagara Escarpment legislation and other accepted policies, such as TRCA's Valley and Stream Corridor Management Program. Environmental management measures such as expanded natural cover, better stormwater management and sustainable community design were superimposed on these land use scenarios.

The sustainable community scenario represented a vision of the watershed with protection of an expanded natural heritage system and full build-out implemented with the most innovative concepts in sustainable community design including

- Minimized impervious cover
- Improved management of infiltration and runoff components of water balance
- Protection of headwater drainage features
- Enhanced urban tree canopy (30 per cent of community)
- 25 per cent backyard naturalization.

This scenario also includes improved sustainability in already urbanized areas (e.g., improved stormwater management, naturalization, green buildings, etc.), increased stewardship of natural areas and improved individual behaviours including energy conservation, water conservation and purchase of local foods. This scenario and the literature basis for its assumptions are described in *Development of a Sustainable Community Scenario for the Rouge River Watershed* (TRCA, 2006).

Finally, the effects of potential climate change were added to the full build-out and sustainable community scenarios. More details on the characteristics and assumptions in each scenario are available in Appendix D and the *Humber River Watershed Scenario Modelling and Analysis Report* (TRCA, 2008a).

Climate Change

Two climate change scenarios for the year 2080 were selected for the modelling studies. Each predicts substantively different types of change in average monthly temperatures and precipitation, allowing us to examine two variations of "worst case" climate change.

- CGCM2 (Scenario A21): Coupled Global Climate Model developed by Environment Canada.
- Hadley (HadCM3 AOECM; scenario A1F1): Coupled Atmosphere-Ocean General Circulation Model developed by Hadley Centre for Climate Prediction and Research in the UK.

The intent of the modelling studies was not to predict **specific** future conditions, but rather to **compare** different land use and management scenarios, ascertain potential changes to selected indicators of watershed health and identify areas of relative sensitivity in the watershed. Modelling was just one source of information. To complement it, existing conditions and trends in the watershed were examined, watershed research in other areas was reviewed and the best professional judgment of a range of experts in many fields was applied. Through this multi-faceted process of analysis and synthesis an increased understanding of possible future conditions was developed. Here are some of the highlights.

Industrial and commercial developments typically create extensive areas of hard (impervious) surfaces that greatly increase stormwater run-off.
Photography by Lou Wise

4.1 WATER

Approved official plan and full build-out with conventional approaches (scenarios 2 & 5)

Most urban growth in the next five to 10 years will occur in the West Humber, East Humber and Rainbow Creek subwatersheds (Figure 3–7). Rainbow Creek, Purpleville Creek and the eastern branches of the West Humber will be the most affected by approved urban growth, as extensive areas of industrial and commercial development (types of land use generally associated with high levels of impervious cover) are planned in these subwatersheds. Although Black Creek subwatershed is completely urbanized and will not experience significant changes in land use in the next five to 10 years, further changes to stream form are expected, because the stream banks are still adjusting to new patterns of stream flow caused by previous development.

Continuing with conventional approaches to development and stormwater management is expected to result in:

- Significant increases in erosion (doubling in some cases and a four-fold increase in others)
- Increases in peak stream flow and possibly severity of flooding
- Decreases in groundwater levels by 0.5 to 2 metres
- Increases in pollution by metals, bacteria and chlorides.

A key to understanding environmental conditions in the watershed is understanding the water budget, which describes the flow of water through the watershed according to the water cycle components: precipitation, groundwater recharge, evapotranspiration, surface runoff and water withdrawals. Urbanization increases the amount of impervious surfaces (e.g., roads, roofs, parking areas) in the watershed and alters the water budget by decreasing the amount of groundwater recharge and evapotranspiration and increasing surface runoff. Conventional approaches to stormwater management rely heavily on stormwater ponds and only control the rate at which stormwater is released to streams while still allowing total runoff volume to increase. This results in major increases in the volume and pattern of flow in rivers and streams.

Modelling studies show that the following changes can be expected as a result of using conventional approaches to development design and stormwater management such as protection of valley and stream corridors, significant woodlands and wetlands and creation of stormwater management ponds (also known as "business-as-usual")

- Increases in total annual flow volumes in rivers and streams due to increased runoff from upstream development and impervious cover, with greatest increases in summer and fall.

- Significant increases in stream bank erosion and channel degradation, despite implementation of stormwater ponds in new developments (Figure 4–1 and Figure 4–2). This will affect channel stability, create new erosion sites and exacerbate existing problem sites, especially downstream in the City of Toronto. Predicted increases in erosion potential include:

  - 100 per cent in the main branch of Rainbow Creek (the Town of Caledon, the City of Brampton and the City of Vaughan) in scenario 2 and 200 per cent in scenario 5

  - 10 per cent in the main branch of the West Humber (the Town of Caledon and the City of Brampton) in scenario 2 and 100 per cent in scenario 5

  - 10 per cent in the lower reaches of the East Humber (the City of Vaughan) in scenario 2 and 35 per cent in scenario 5

  - 20 per cent in the main channel of the Humber River at Steeles Avenue (the City of Vaughan and the City of Toronto) in scenario 2 and 40 per cent in scenario 5.

- Increases in peak stream flow rates and possibly in severity of flooding in flood prone areas, despite implementation of stormwater ponds in new developments. The surface water model predicted significant increases in flood flows in and near several flood vulnerable areas. Although these results need to be verified through further study, they suggest that conventional approaches to stormwater management for flood control may not be adequate.

- Minor decreases in groundwater levels in portions of all Humber aquifers—Oak Ridges Aquifer, Thorncliffe Aquifer and Scarborough Aquifer Complexes—in the range of 0.5 to 2 metres in both scenarios (2 and 5). The protective policies of the *Greenbelt Plan*, *Oak Ridges Moraine Conservation Plan* and *Niagara Escarpment Plan* contribute greatly to protecting important recharge areas that contribute to the Humber groundwater system. Build-out of approved official plans and remaining lands not yet protected from urban growth by provincial policies would primarily occur on clay soils of the Peel Plain and South Slope with generally low recharge rates.

- Changes in water quality in streams and rivers, with increases in metals, bacteria and chlorides and decreases in total suspended solid and phosphorus concentrations.

  - Bacteria levels are predicted to increase.

  - Copper and zinc concentrations are predicted to increase and begin to exceed water quality guidelines intended to protect aquatic life.

– Chlorides (primarily from road salt) would increase in all watercourses downstream of development, potentially to levels that are toxic to aquatic life (chloride levels in Black Creek, the City of Toronto and the lower reaches of the West Humber already exceed water quality guidelines).

– Decreases in total suspended solids and phosphorus levels because most future development will occur on soil that is exposed to erosive forces on an annual basis (lands currently used for crop production) and because urban runoff will be treated by stormwater management ponds that help to remove suspended solids and phosphorus.

– Phosphorus loads to Lake Ontario from the Humber watershed would decrease by 15 per cent under full build-out, assuming the City of Toronto's aggressive stormwater retrofit plan (Wet Weather Flow Management Plan) is implemented.

Approved official plan build-out with stormwater management improvements (scenario 3)

Retrofitting existing ponds provides local benefits whereas introducing ponds to areas that have no stormwater treatment can create greater benefits overall.

Scenario analysis also considered the effects of improving existing stormwater management ponds or constructing new ones in existing developed areas where there are known opportunities. These measures would result in local downstream water quality and erosion control benefits. However, due to the limited numbers of opportunities for new or improved ponds in existing developed areas and the limited additional urban area that would receive treatment, it was found that in most subwatersheds these measures **alone** would not be enough to provide significant improvements. As discussed in Section 3.1.4, ponds are limited in the benefits they can provide for erosion control, and need to be augmented by source and conveyance control measures that reduce the total volume of runoff. Retrofitting an existing pond may achieve an additional 50 to 70 per cent benefit in water quality treatment for sediment removal in comparison with the greater benefit of introducing ponds to areas that previously had no stormwater treatment. New ponds sized to current standards could achieve an 80 per cent benefit to water quality in areas with no existing stormwater treatment.

Identifying additional storage sites, for example underground or on private property, could increase the number of facilities and the overall effectiveness of such initiatives. However the cost of securing these additional sites may be greater than the cost of lot-level stormwater management and naturalization strategies that can help to manage the water balance by reducing runoff and increasing recharge and evapotranspiration. These strategies also provide a number of other watershed management benefits. For example, rain gardens and naturalized landscaping contribute habitat, rain-harvesting offsets potable water demand, and green roofs moderate climate and provide energy conservation and air quality benefits.

However stormwater management pond retrofits can provide local benefits in terms of improved water quality and reduced erosion. Where opportunities exist, the local benefits are high relative to costs and can be realized in a shorter timeframe than incremental implementation of lot level practices.

Official plan build-out with expanded natural cover (scenario 4)

Expanding natural cover from 32 per cent to 42 per cent of the watershed area was examined through this analysis (based on an interim target terrestrial natural heritage system for the watershed). Increasing natural cover is expected to result in reductions of stream flows and erosion potential proportional to the amount of additional cover within each subwatershed.

Figure 4–1: Change in erosion potential – approved official plan build-out (Scenario 2)

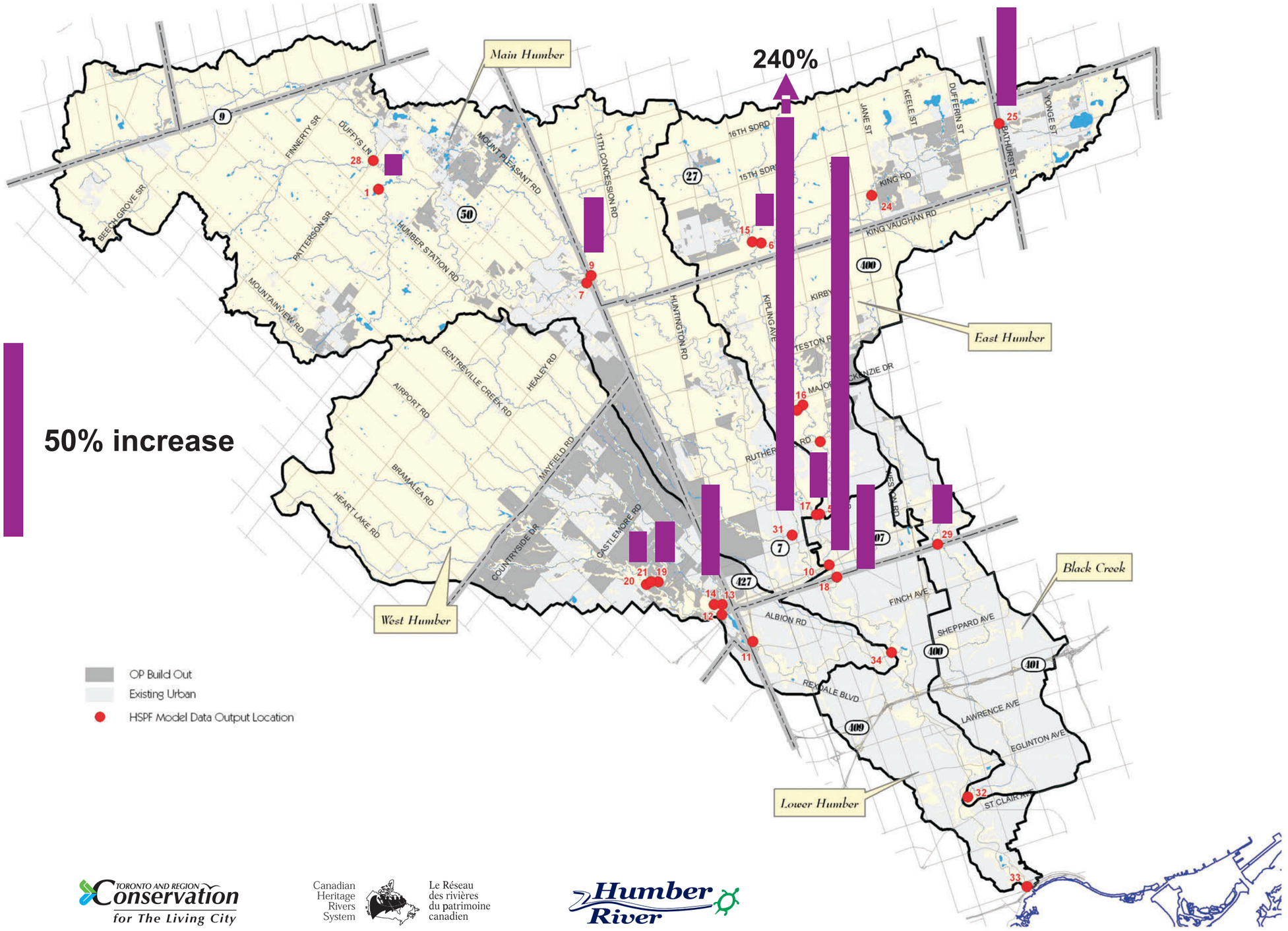
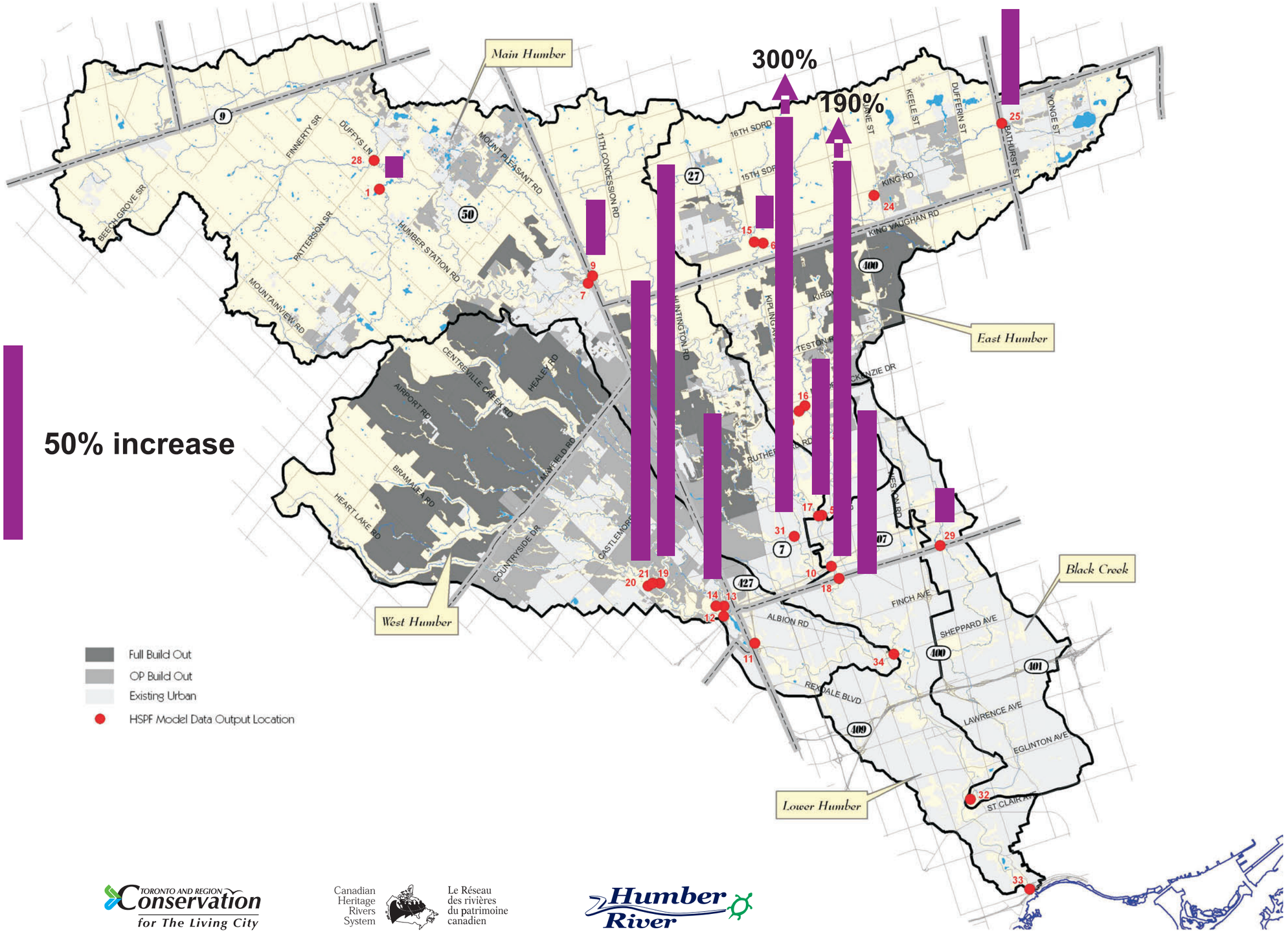


Figure 4–2: Change in erosion potential – full build-out (Scenario 5)



It is predicted that expanding natural cover in the Main Humber, East Humber and main and west branches of the West Humber would result in decreases in erosion potential sufficient to mitigate predicted increases resulting from the build-out of approved municipal official plans, with the exception of Rainbow Creek. Expanded natural cover in the headwaters of the Main Humber and East Humber was also predicted to reduce peak stream flows which would mitigate increases from build-out of approved municipal official plans and possibly help to reduce risk of flooding during some types of storm events, but not for extreme events such as regional storms like Hurricane Hazel.

Expanding natural cover will mitigate predicted increases in erosion potential in the Main Humber, East Humber and parts of the West Humber, but will not be sufficient to mitigate impacts in the subwatersheds of Rainbow Creek, the east branch of the West Humber and Purpleville Creek.

The most pronounced water quality benefits of expanded natural cover are expected for total suspended solids and nutrients because vegetation helps to prevent soil erosion and absorbs nutrients. Modelling results suggested decreases in concentration of 10 to 30 per cent. These benefits were greatest immediately downstream of major increases in natural cover (e.g., Cold Creek, King Creek and upper reaches of the Main Humber).

It should be noted that even with implementation of expanded natural cover, the extent of urbanization planned in the subwatersheds of Rainbow Creek, the east branch of the West Humber and Purpleville Creek will still cause significant impacts to stream flow and channel stability in these watercourses. From a water management and stream erosion perspective, strategic reforestation programs should focus on lands throughout the headwaters of Rainbow Creek (the Town of Caledon and the City of Vaughan), the upper West Humber tributaries (the Town of Caledon) and Purpleville Creek (the City of Vaughan).

Sustainable communities (scenario 6)

The combination of implementing sustainable community initiatives in both new greenfield development and existing urban areas such as enhanced stormwater management and increased natural cover, as applied in the sustainable communities scenario, could reduce the negative effects of urbanization described above, but are generally not expected to fully offset them (Figure 4–3). Reductions in negative impacts would likely be more pronounced in areas of new development than in existing urban areas, where opportunities to retrofit with sustainable technologies are limited:

Sustainable community initiatives will reduce the impacts of urbanization, but will not offset them completely.

- Significant impacts on stream flow volume and erosion potential would still occur in Rainbow Creek, the main and east branches of the West Humber and Purpleville Creek.
- In some areas (upper East Humber and King Creek subwatersheds) it is possible that existing stream flow volumes, peak flows and erosion potential could be maintained.
- In the Main Humber, reductions to stream flow volume, erosion potential and peak flows could be achieved (especially in Centreville Creek and Cold Creek), while still accommodating the limited amount of urban growth approved in these subwatersheds by existing municipal official plans.
- Complete mitigation could be achieved to offset the predicted increases in severity of flooding during some types of storm events, but not for extreme events.

- A reduction in phosphorus loads to the lake was predicted with implementation of sustainable community initiatives in greenfield development areas and existing urban areas in the 905 area code municipalities.

Climate change (scenarios 5A, 5B, 6A and 6B)
It is predicted that annual volumes of stream flow would decrease under all the climate change scenarios examined, despite precipitation increases, due to increased temperatures and greater evapotranspiration. Providing that sufficient infiltration opportunities are retained in urbanizing areas, groundwater recharge, discharge and aquifer levels could increase because of higher rainfall.

It is not yet possible to draw specific conclusions about the effects of climate change on surface and groundwater systems and further study will be required as the science of climate change prediction evolves.

However, due to limitations in current approaches to climate change prediction, the magnitude and seasonality of changes to temperature and precipitation in the Greater Toronto Area may differ significantly from the scenarios examined. Also, the climate change scenarios do not include the increases in frequency and intensity of storms that many scientists anticipate as outcomes of climate change. Such changes would result in more frequent periods of extreme flows, flooding and increased erosion potential. Therefore it is not yet possible to draw specific conclusions about the effects of climate change on surface and groundwater systems and further study will be required as the science of climate change prediction evolves.

4.1.1 AQUATIC SYSTEM

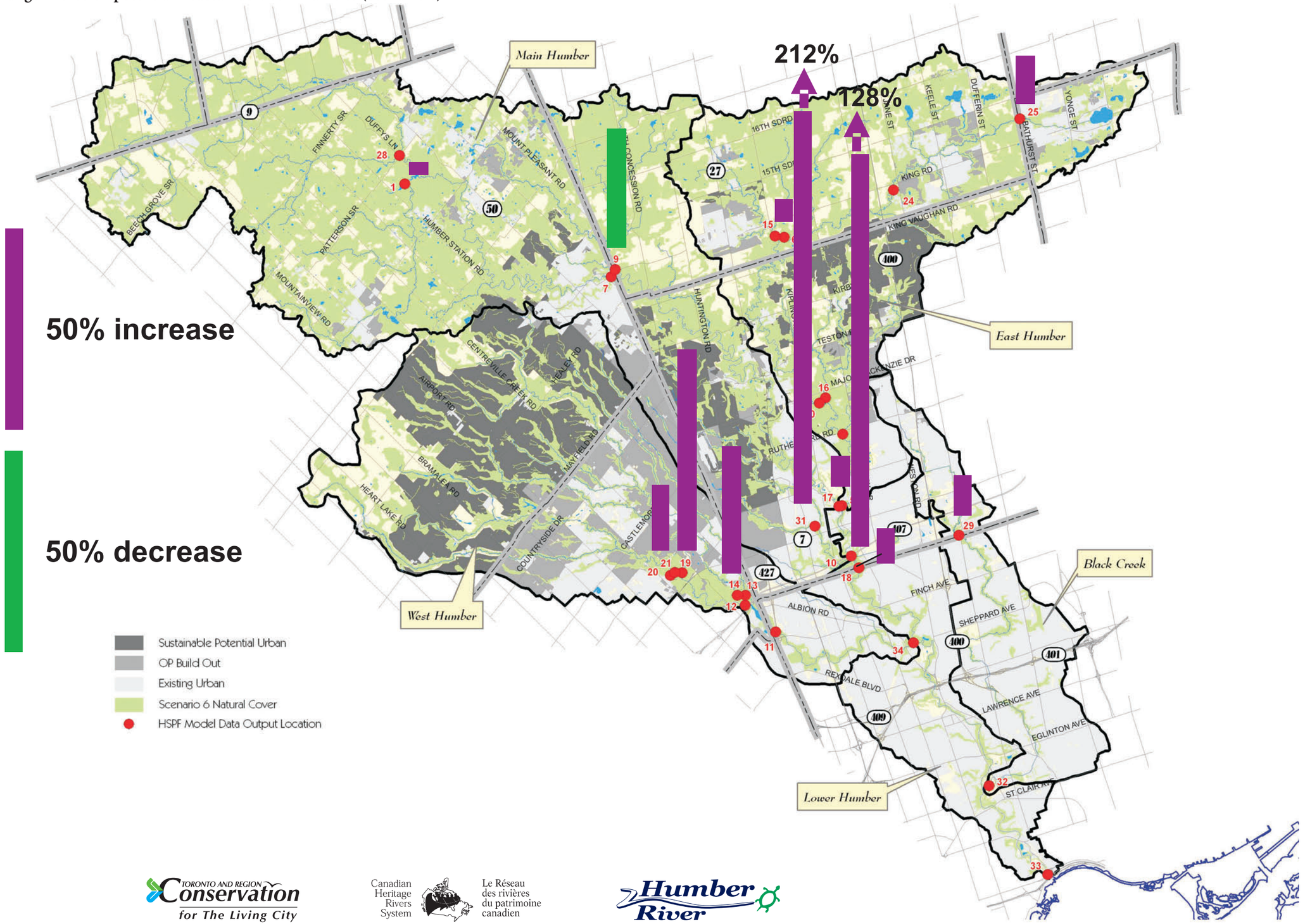
Prediction of likely future conditions in the aquatic system was based on the modelling of land use scenarios, combined with scientific interpretation of empirical data and an understanding of the hydrologic and physiographic relationships in the watershed.

Approved official plan and full build-out with conventional approaches (scenarios 2 & 5)
This analysis showed that widespread negative impacts are expected to result from development according to approved official plans (scenario 2), if it is undertaken with conventional approaches to environmental management. These impacts include a shift from existing cool water to warm water conditions, increased stream flow velocities, turbidity and siltation in the middle reaches of the watershed. Associated with such changes in stream form and function would be changes in aquatic community structure and reduced biodiversity in both the middle and lower sections of the watershed. Such changes are of particular concern in the lower reaches of the West and Main Humber, and Purpleville Creek. Further declines would be expected with full build-out to the limits of the Greenbelt (scenario 5), again assuming conventional approaches to environmental management.

Conventional development will likely result in widespread negative impacts on aquatic systems, including a shift from cool water to warm water conditions, significant habitat degradation and the loss of many species.

Approved official plan build-out with expanded natural cover (scenario 4)
If the targeted natural heritage system is fully implemented during build-out of approved official plans, many of the expected negative impacts will be avoided and a positive change toward net improvement in the aquatic system is expected in the headwaters of the watershed in relation to existing conditions. However increased natural cover alone will not be enough to achieve improvements with full build-out to the limits of the Greenbelt. In this case, it will be essential to combine an increase in natural cover with improved stormwater management based on sustainable practices that maintain pre-development stream flow conditions as nearly as possible.

Figure 4–3: Change in erosion potential – sustainable communities (Scenario 6)



Canadian Heritage Rivers System / Le Réseau des rivières du patrimoine canadien

4.1.2 TERRESTRIAL SYSTEM

Terrestrial habitats are currently fragmented in much of the watershed, although there are considerable blocks in the Niagara Escarpment and Oak Ridges Moraine areas.

Approved official plan and full build-out with conventional approaches (scenarios 2 & 5)
Implementation of approved official plans with conventional approaches to natural heritage protection (scenario 2) will result in a decrease in natural cover in all of the subwatersheds, as well as a significant decrease in quality of the remaining natural areas, due to fragmentation and the negative influences of the urban matrix. Full build-out to the limits of the Greenbelt (scenario 5) would exacerbate these declines, resulting in significant losses of biodiversity and ecosystem functions.

Approved official plan build-out with expanded natural cover (scenario 4)
Implementation of an expanded natural heritage system with official plan build-out (scenario 4) would result in a substantial increase in natural cover, up to 42 per cent of the watershed (based on an interim target system) compared with the current 32 per cent. It would also improve the overall quality, distribution and connectivity of habitats to a significant degree. For example, the total area of natural cover patches ranked as "good" quality would increase by approximately 10,000 hectares in the Main Humber subwatershed and 5,000 hectares in the East Humber. Improvements in connectivity would be mainly through valleyland connections, with some improvements to tableland connections in the northern reaches of the watershed. This enhanced terrestrial system would be better able to withstand the negative influences of urbanization and would also be more resilient to impacts from invasive species and climate change. The larger habitat areas would provide more space to accommodate both wildlife and nature-based recreation opportunities.

Implementation of the targeted natural heritage system with official plan build-out would increase "good" quality habitats, for example by 15,000 hectares in the Main and East Humber subwatersheds.

Sustainable communities (scenario 6)
In comparison with scenario 4 (approved official plan build-out with expanded natural cover) the overall effect of increased urbanization in scenario 6 will be decreases in quality of habitats near or within urban areas, particularly in the headwaters of the West Humber subwatershed. However major improvements to habitat connectivity and quality over current conditions and full build-out with conventional approaches (scenario 5) would still be achieved.

4.2 SUMMARY

The scenario modelling and analysis shows that if future development proceeds with conventional approaches to community design and stormwater management, it will not be possible to maintain current environmental conditions, let alone improve them. Instead, there will be additional deterioration of environmental conditions and associated quality of life. Even if the most innovative sustainable community measures are applied, this deterioration cannot be completely prevented throughout the watershed. The anticipated effects of climate change may exacerbate these concerns. These insights highlight the need to adopt new management approaches and take actions that will increase the resilience of the natural systems to anticipated future stresses.

CHAPTER

5

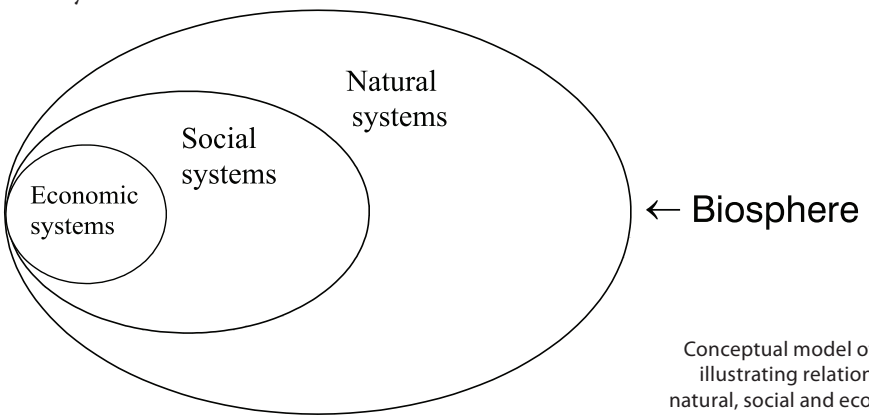
5.0 STRATEGIES

5.1 MANAGEMENT PHILOSOPHY

The Humber watershed has experienced rapid urbanization in recent decades and is showing signs of serious stress on its environmental systems and quality of community life. With the projected population growth of another 4.5 million people in the Greater Toronto Area over the next 20 years (Hemson, 2005), the watershed will continue to experience urban development pressures.

Today, the watershed faces ongoing urban growth pressures combined with an urgent need to improve sustainability of existing urban areas and restore degraded streams. Continuing with "business as usual" will result in considerable and ongoing harm to the watershed's environmental systems. Clearly, a new approach is needed to address these challenges. Fortunately, understanding of watershed management has improved over the past two decades, and a considerable body of science, technical advances and real life examples are available to map a better, more sustainable path forward.

It is clear that this new approach must be rooted in the concept of sustainability because it provides a comprehensive framework for meeting multiple objectives, not only for a healthy environment, but also for economic vitality and community health and well-being. The diagram below provides a way of visualizing the relationships among these three major systems. The biosphere includes all living organisms on earth, together with their physical environments. The natural systems are the non-human elements of the biosphere. Human social systems are dependent on the natural ones for their health and survival. Economic systems are embedded within the social systems.



Conceptual model of the biosphere illustrating relationships between natural, social and economic systems

Increasingly, public agencies in the watershed and in other regions across the country are recognizing the interdependencies of our environment, our economy and our communities. Examples include sustainability strategies developed by the City of Toronto, the Regional Municipality of Peel, the Regional Municipality of York and TRCA's vision for The Living City. All these initiatives are working toward a healthy, attractive, sustainable urban region. They are rooted in the understanding that sustainability means "meeting the needs of the present generation without compromising the ability of future generations to meet their needs" (United Nations Brundtland Commission, 1987). They guide us to change our approaches to watershed management

- From mitigation to prevention
- From degradation to restoration and net gain
- From end-of-pipe to source control of stormwater
- From waste disposal to resource recovery
- From single issue focus to multiple benefits
- From piecemeal projects to integrated management.

Sustainability in Greater Vancouver

Recent work in Greater Vancouver provides another example of thinking about sustainability. Their strategy is based on a green web composed of linked blocks of natural cover interlaced with the blue ribbons of rivers and streams. It envisages attractive, liveable and compact communities nestled within the green web and between the blue ribbons. Each community and each lot will be designed and managed for sustainability (Sheltair Group Inc., 2003).

What will this mean for the Humber Watershed?

Efforts must begin by protecting and enhancing a healthy, functioning natural system as the basis for a sustainable community. Then sustainability concepts must be applied at all scales (e.g., watershed, community, and building/site scales) such that the land use matrix supports the broader natural system and the built forms facilitate sustainable lifestyle choices by individuals.

A land use framework that provides adequate space for people and their activities must be established while minimizing disruption to the natural water balance and designating space for natural cover and wildlife habitats. The *Growth Plan for the Greater Golden Horseshoe* and the *Greenbelt Plan* provide overall direction for this land use framework. This *Humber River Watershed Plan* provides specific guidance for future development and redevelopment at subwatershed, community and individual property scales.

The specific strategies below are designed to restore a more natural water balance, maintain or improve biodiversity, and remediate degraded rivers and streams. They show how new development areas can be planned and managed differently from past and current practices. The strategies also address ways to accommodate human activities to capitalize on the rich natural and cultural heritage of the watershed without damaging its resources.

5.2 HOW THE STRATEGIES WERE DEVELOPED

The following management and implementation strategies are derived from a collaborative approach involving TRCA staff, stakeholders, consultants and peer review experts over a three-year timeframe. Following a review of current conditions (*Listen to Your River: A Report Card on the Health of the Humber River Watershed, 2007*; and *Humber River State of the Watershed Reports, 2008*), scenario modelling was undertaken to predict the response of the watershed to potential future conditions. Experience from other watershed jurisdictions was reviewed. A list

of potential management actions was developed to achieve the watershed plan objectives and targets. Finally, a series of management summits was held to identify key management strategies and refine the specific actions.

The integrated approach of this management plan means that each management strategy may address a number of different objectives. For example, the management strategy for stormwater retrofits addresses objectives for groundwater, surface water, stream form and aquatic communities. Generally, strategies were grouped according to the primary objective they would accomplish, and cross-referenced to other objectives where relevant.

The following sections describe management and implementation strategies under three broad headings: Environment, Society, and Economy. Section 6 and the *Humber River Watershed Plan Implementation Guide* provide more specific guidance for high priority initiatives that will implement the recommendations in this Watershed Plan.

5.3 ENVIRONMENT

5.3.1 WATER

Objectives

1. Protect the form and function of the Humber River and its tributaries
2. Protect groundwater recharge and discharge
3. Prevent groundwater contamination
4. Protect and restore the natural variability of annual and seasonal stream flow
5. Maintain and restore natural levels of baseflow
6. Eliminate or minimize risks to human life and property due to flooding
7. Protect and restore surface water quality, with respect to toxic contaminants and other pollutants (such as sediment, nutrients, bacteria and road salt)
8. Manage stormwater to protect people and the health of streams and rivers

In order to achieve these objectives, it is necessary to restore and maintain, to the extent possible, an appropriate year-round and seasonal balance of groundwater and surface water flow through the watershed.

The review of current conditions in Chapter 3 highlighted the following issues

Groundwater

- Need to protect drinking water sources from potential sources of contamination or reduction in availability
- Potential for new development and associated subsurface infrastructure to change groundwater levels, flow paths and patterns of groundwater discharge
- Land use decisions in watersheds bordering the Humber to the north and west have the potential to affect environmental conditions in the Humber watershed.
- Land use decisions in the portion of the Humber watershed bordering the Rouge and Don River watersheds have the potential to affect environmental conditions in those watersheds.

Surface Water

- Inadequate stormwater management control in older urban areas
- Stormwater management facilities require periodic maintenance to retain designed level of treatment but funding mechanisms are not yet available
- Inadequate application of erosion and sediment control on urban construction sites and enforcement capabilities
- Impacts of pollutants and increasing chloride concentrations on aquatic life
- Impacts of bacteria levels on recreational opportunities
- Continued occurrence of spills
- Careful management of developments within flood prone areas as well as in upstream drainage areas is required to minimize risks to life and property.

Stream Form

- Unnaturally high rates of erosion
- Lack of channel stability
- Habitat degradation
- Reaches with little or no riparian cover
- Infrastructure and private property at risk of exposure, damage or failure.

Many of these issues will continue to worsen, even if there was no more development in the watershed because the watershed has not finished responding to the impacts of existing development. So the watercourses will continue to erode, widen and deepen. The anticipated effects of climate change may add further stresses to the system.

Development of the Humber watershed will continue through the implementation of existing municipal official plans. Beyond that time, there is likely to be further development in some municipalities up to the boundaries of the Greenbelt and the Oak Ridges Moraine protected areas, assuming that these policies are maintained.

Clearly new approaches to restore and maintain an appropriate water balance for a healthy watershed are needed. But first, it is helpful to review lessons learned from previous approaches to water management in existing developed areas.

Portions of Black Creek have been channelized to reduce risk of flooding.
Photography by Jamie Duncan

Over the past six decades, different approaches to stormwater management have been applied in an effort to address impacts from urbanization. Following the devastating effects of flooding by Hurricane Hazel in 1954, the primary approaches were to prevent building in floodplains and to convey water away from urban areas as quickly as possible. Urban design standards required lot grading to maximize runoff from each building site so that roadways, ditches and storm sewers could quickly transfer water to streams and rivers. In some cases, watercourses were straightened, enlarged and lined with concrete or stone to accommodate the increased runoff volumes and velocities. In the early 1980s it was recognized that in many cases, these measures actually worsened downstream flooding and erosion. In response, there was a move to direct water from subdivisions to stormwater detention ponds that reduced the peak stream flows from major storm events.

From top left: green roof, porous pavement, grassed swale, parking lot bioretention area

In the early 1990s, the design of stormwater ponds was modified in an attempt to treat stormwater quality and reduce downstream erosion by increasing detention times, providing more time for pollutants to settle and reducing outflow rates. Experience has shown that such ponds can be an adequate means of minimizing impacts on water quality and helping to manage flood risks when combined with strong floodplain management policies. However, emerging monitoring studies show that stormwater ponds alone are insufficient to reduce erosion and impacts on aquatic habitats caused by increases in stormwater runoff volume and changes to the natural pattern of stream flow.

Recently, the realization that declines in river system health are still occurring has lead to a significant shift in approach to urban stormwater management. The new philosophy takes a more holistic approach aimed at achieving multiple benefits including control of flooding, protection of water quality and aquatic and terrestrial habitats, reductions to in-stream erosion, maintenance of groundwater recharge and avoidance of groundwater contamination by pollutants. The thrust of this new philosophy is a multi-barrier, "treatment train" approach.

First, efforts are made to maintain the pre-development water budget, to the extent possible, by first encouraging infiltration and evapotranspiration through community design that minimizes imperviousness and through

Examples of stormwater management techniques

Lot level or at-source
- Rain gardens
- Green roofs
- Porous paving
- Rainwater harvesting

Conveyance
- Infiltration trenches
- Grassed swales
- Exfiltration pipes

End-of-pipe
- Stormwater ponds
- Underground detention

For more information, see TRCA STEP (Sustainable. Technology Evaluation Program) **www.sustainabletechnologies.ca**

measures on each building lot, or "at source" controls. The second line of defence is to infiltrate water into the ground during conveyance (e.g., from stormwater pipes or grassed swales). Thirdly, "end-of-pipe" measures such as detention ponds and underground tanks are viewed as part of the multi-barrier "treatment train" approach and not as stand alone solutions. Sometimes referred to as "low impact development", this approach for protecting and managing the natural heritage and hydrological systems is an integral part of sustainable community design concepts.

Implementing strategies to remediate environmental conditions caused by previous development is a long-term, costly endeavour. For example, the City of Toronto estimates a cost of $40 million/year over 100 years to retroactively implement such strategies through its Wet Weather Flow Management Plan. As development continues in the Humber watershed, it is now obvious that it will be more cost effective, and less harmful to the environment, if this new approach to development can be applied, avoiding more remediation expenses in the future.

Looking ahead to potential future conditions, it is expected that the West Humber, East Humber and Rainbow Creek subwatersheds will be subject to the greatest amount of new development and increases in the severity of the issues noted above. Because the upper portion of the Main Humber subwatershed will experience much less development, due to the protective policies of the *Niagara Escarpment Plan*, *Oak Ridges Moraine Conservation Plan* and *Greenbelt Plan*, it will show fewer negative impacts, but will still require management to meet the Watershed Plan objectives and targets.

The analyses undertaken to prepare this plan showed that in order to avoid further impacts, and in some cases achieve improvements over existing conditions, it will be necessary to apply an integrated suite of measures. They include:

- Improvements to stormwater management (mostly at the lot level) with special consideration of technologies such as rainwater harvesting and green roofs in areas with clay soils at surface and thick aquitard layers underneath (e.g., portions of the West Humber, Rainbow Creek and Purpleville Creek subwatersheds (Figure 3 7)
- Selected end-of-pipe retrofits in existing urban areas (highest priority projects should be those in combined sewer areas)
- Increased natural cover
- Sustainable community initiatives, both to retrofit existing urban areas and when developing new greenfield areas.

Sustainable community initiatives for greenfield developments encompass a number of key strategies, including reduction of impervious cover through innovative community design, stormwater management strategies based on source controls at the lot level to minimize disruption of the water budget, pollution prevention and other stewardship practices.

New greenfield development should be phased to reduce the extent of overall soil disturbance in the watershed during the construction phase while other water budget management measures (e.g., increased natural cover, lot level and conveyance stormwater management) are incorporated into land use and stormwater management plans. This phased approach will also allow monitoring and evaluation of the performance of new technologies, as well as the watershed response, so that continuous improvements can be incorporated in future applications. Flexibility will be required to adjust management strategies promptly, if necessary.

In order to realize the long-term benefits of building sustainable communities, it will be critical that new and existing stormwater management and flood control infrastructure is properly maintained. The increased focus on lot-level management of stormwater in new communities will create new challenges to ensure appropriate maintenance and stewardship on private property. To this end, education and awareness programs and incentives, backed up by enforcement measures, should be established to foster improved voluntary uptake and long-term care of stormwater management measures.

Current initiatives

The City of Toronto's *Wet Weather Flow Management Plan* and accompanying guidelines (City of Toronto, 2006) recommend retrofits to existing stormwater systems to improve control of the runoff that flows to the lower reaches of the Humber River and Black Creek. Several retrofit projects have already been implemented in the watershed (City of Toronto, 2007b).

Retrofitted stormwater management pond near Colborne Lodge Drive in Toronto. Photography by Dean Young

To better monitor and manage flooding, TRCA has initiated improvements to the Flood Warning Program, focusing on ease of access to current flow conditions at flood prone areas and flood control dams. New or improved stream flow and precipitation gauges allow for web-based, real time access to information.

Municipalities in Peel and York and the City of Toronto have developed management plans for their road de-icing salt application programs, as required by Environment Canada.

The regional municipalities of Peel and York have well-established wellhead protection programs in place for their municipal groundwater wells. Along with Durham Region and the City of Toronto, they have been working in partnership to improve understanding and management of the regional groundwater system. Part of this work has focused on developing a regional scale groundwater flow computer model that consolidates available groundwater and geologic information.

A study by the National Water Research Institute is using DNA fingerprinting technologies to identify the relative importance of fecal matter from various sources (e.g., humans, pets, geese, livestock) to bacteria levels along the Lake Ontario waterfront near the mouth of the Humber.

A number of pilot studies in the Humber watershed are evaluating various lot level stormwater management systems. For example, TRCA Sustainable Technologies Evaluation Program (STEP) is evaluating the benefits of a permeable paving and parking lot bioswale infiltration system on the Seneca College campus in the Village of King City. Pilot testing in the Yonge West development area in Town of Richmond Hill is providing information about the performance of soakaway pits and permeable pavement. A pilot study on the Bramport lands in the City of Brampton evaluates the effectiveness of an underground stormwater infiltration system that will service a "big box" commercial development located on clay soils. A pilot study in the City of Vaughan demonstrates leading edge erosion and sediment control practices on a construction site. The City of Vaughan is testing the use of polymers to improve the ease and efficiency of stormwater management pond sediment removal maintenance work.

Strategies

The recommended strategies for water encompass ten inter-related themes:

1) Protect recharge and discharge
2) Increase natural cover
3) Improve sustainability of development design
4) Improve erosion and sediment control and site restoration
5) Implement stormwater retrofits
6) Maintain stormwater infrastructure
7) Prevent pollution
8) Manage flood risks
9) Protect stream form
10) Monitor, evaluate and adjust

Strategy 1. Protect recharge and discharge

It is essential to protect the volume and pattern of recharge, an important element in managing the water budget, because it sustains aquifer water levels, baseflow in streams and cold water fish habitat. Municipal plans, policies and regulations should support protection of groundwater recharge and discharge functions as well as subsurface flow directions.

Protecting and maintaining the volume and pattern of recharge will be especially important in high volume recharge areas that significantly contribute to maintaining aquifer water levels and groundwater flow directions. In the Humber watershed, the majority of these areas occur on the porous soils and hummocky topography of the Oak Ridges Moraine and Niagara Escarpment. It is believed that portions of the Credit River, Nottawasaga River and Holland River watersheds that border the Humber are high volume recharge areas that contribute to the Humber groundwater system. The land use designations of the *Oak Ridges Moraine Conservation Plan*, *Niagara Escarpment Plan* and *Greenbelt Plan* already protect most of these areas from urban growth and will contribute to appropriate management of land uses. However, some high volume recharge areas in the City of Vaughan and the Town of Caledon are located in potential future urban growth areas (such as the whitebelt).

Equally important will be protecting and maintaining the function of local recharge areas that contribute groundwater flow to tributaries where target fish species rely on groundwater discharge. Tributaries of the Humber River where this is the case include, but are not limited to, Centreville Creek, Cold Creek and the upper East Humber River.

Mechanisms for protecting recharge and discharge functions include protection and expansion of natural cover, careful development site design and application of infiltration-based stormwater management measures. The best way to maintain recharge and discharge functions in urbanizing areas is to review opportunities early in the development planning process, and set aside significant recharge areas for inclusion in the natural heritage system. Decisions regarding how to best protect recharge and discharge functions in proposed developments should be made through broad scale urban growth planning and optimization of site designs through subwatershed scale studies. This Watershed Plan and its supporting documents should be used to inform such planning studies.

TRCA will need to continue to work with neighbouring conservation authorities, the Regional Municipality of Peel and the Regional Municipality of York to improve understanding of the complex groundwater flow patterns that exist where the Niagara Escarpment and Oak Ridges Moraine meet as well as the importance of recharge areas outside the Humber watershed boundary to environmental conditions in the watershed.

The regional municipalities of Peel and York should consider adopting policies to protect the function of significant recharge areas (such as high volume recharge and important local recharge areas).

Recommendations

1. Identify and protect recharge (Figure 3–5) and discharge as well as subsurface flow directions through municipal plans, policies and regulations
   - Protect and maintain the function of high volume recharge areas and local recharge areas for those reaches that are heavily reliant on local sources of groundwater discharge (e.g., Centreville Creek, Cold Creek and upper East Humber).
   - Review opportunities early in the development planning process to set aside important recharge areas for inclusion in the open space or natural heritage system Undertake this broad scale urban growth planning and optimization of site designs through subwatershed scale studies.

2. Maintain complex groundwater flow directions, particularly where groundwater is believed to be flowing across watershed boundaries
   - In planning and design of new subsurface infrastructure (e.g., sewers water mains) avoid areas where the water table is predicted to be shallow. Where construction below water table is necessary, mitigate impacts on groundwater flow and discharge.
   - In developments where water table is shallow convey cool, clean groundwater collected by foundation drains directly to watercourses or wetlands rather than stormwater management ponds, where feasible, to avoid contamination and increases in temperature.

Lead responsibility: Municipalities
Other partners: Province, TRCA, Credit Valley Conservation Authority, Nottawasaga River Conservation Authority, Lake Simcoe Region Conservation Authority.

Strategy 2. Increase natural cover

The target terrestrial natural heritage system for the watershed, identified in Section 5.3.4, is an essential part of the strategies to manage and improve the water balance. It will help to reduce surface runoff, attenuate peak flows and improve water quality. Components of this system that are particularly important to water balance are wetland protection and restoration and the protection of stream corridors and ephemeral water features.

Recommendations

3. Municipalities should review their official plans and consider adopting natural heritage policies and strategies to achieve a target terrestrial natural heritage system based on the system shown in Figure 5–2.

4. Implement natural cover improvements as quickly as possible in the headwaters of the West Humber, Purpleville Creek, upper East Humber and Rainbow Creek subwatersheds in advance of future urbanization, to help mitigate predicted impacts on stream flow and erosion
    - Priority should be given to the headwaters of the tributaries that flow through approved urban growth areas.
    - In some areas, restoration of wetlands is more appropriate and effective for water management purposes than reforestation (e.g., on the clay soils of the West Humber).

Lead responsibility: TRCA, municipalities
Other partners: Province, businesses and residents

Strategy 3. Improve sustainability of development design

Innovative urban design forms and behavioural shifts will be necessary to achieve our objectives for water management. It is important to shift attitudes away from "stormwater as a waste to be disposed of" to "stormwater as a valued resource with many beneficial uses". The form, design and stormwater management of all new developments should reflect this thinking by minimizing impervious areas, and aiming to maintain pre-development infiltration, evapotranspiration and surface runoff volumes. Consideration of a policy for "no net loss of topsoil", as a means of reducing loss of soil moisture storage capacity, is also recommended.

Stormwater as a resource

- Design new buildings to enable rainwater harvesting and use for non-potable purposes (e.g., toilet flushing).
- Educate watershed residents, businesses, agencies and regulators regarding the benefits of lot level source control measures such as rainwater harvesting and water conservation.
- Use social marketing strategies and develop incentives for desirable stormwater management measures.

To accomplish these changes the Province, in cooperation with the Association of Municipalities of Ontario and Conservation Ontario should prepare development standards to guide more sustainable community design as part of implementation of the *Growth Plan for the Greater Golden Horseshoe*. Related to this effort is the need for updated stormwater management guidelines. Similarly, watershed municipalities should review their engineering and community design standards and make revisions and upgrades where possible to ensure that they allow adequate flexibility to meet stormwater management objectives (e.g., road drainage measures).

The modelling and analysis undertaken in preparing this plan showed that state-of-the-art stormwater management ponds alone cannot maintain erosion at existing levels at a subwatershed scale (see also Section 3.1.4). Stormwater management strategies for future urban expansions need to consider the subwatershed scale, in addition to impacts to receiving tributaries. This will provide a better basis for stormwater pond design and other supportive measures in the stormwater management system. For example, in some areas such as portions of the West Humber and Rainbow Creek subwatersheds, where clay soils and a thick aquitard layer are present with no underlying aquifer to absorb infiltrated runoff, stormwater management in proposed developments many need to rely on engineered infiltration technologies, porous pavement, rainwater harvesting, green roofs and naturalized landscaping to minimize changes to pre-development water budget.

Recommendations

5. Encourage innovative urban design forms that minimize impervious areas and aim to maintain pre-development recharge, evapotranspiration and surface runoff volumes.

6. Municipalities should prepare or update comprehensive stormwater management master plans for enhanced controls and low impact development including
   - best management practices for at source, conveyance and end-of-pipe controls to maintain predevelopment water balance for existing urban areas and new developments
   - strategies for phasing in appropriate requirements as new technologies are tested and proven
   - strategies for sustainable funding for stormwater management infrastructure improvements, maintenance and operations.

7. Consider a policy for "no net loss of topsoil", as a means of reducing loss of soil moisture storage capacity and ensuring sites are amenable to restoration of vegetation after construction.

8. Prepare development standards for sustainable community design and updated stormwater management guidelines.

9. Consider the subwatershed scale in developing stormwater management strategies for future urban expansions, in addition to the impacts to receiving tributaries.

10. Review provincial and municipal engineering and community design standards and revise where necessary to ensure they provide adequate flexibility to meet stormwater management objectives (e.g., road drainage).

11. Implement and evaluate innovative technologies through pilot projects in new developments.

12. Create incentives for residents, businesses and institutions to implement enhanced stormwater management controls that minimize and treat runoff (e.g., rain gardens, infiltration trenches, rainwater harvesting cisterns and green roofs).

13. Provide a streamlined approvals process for projects that go beyond regulatory requirements for stormwater management.

Lead responsibility: Province, Association of Municipalities of Ontario, Conservation Ontario, TRCA, municipalities

Other partners: Greater Toronto Home Builders Association-Urban Development Institute, developers and their consultants.

Strategy 4. Improve erosion and sediment control and site restoration

Even with controls, construction activities can result in considerable soil erosion, higher runoff and harmful effects on watercourses due to increased flows and sedimentation. Traditional greenfield development often occurs over large areas and entire concession blocks may be stripped of vegetation for months or even years. If this pattern continues, several blocks across the West Humber, East Humber and Rainbow Creek subwatersheds could be exposed to

Construction site erosion and sediment controls and stormwater management ponds need careful installation and routine inspection and maintenance to function effectively.
Photography by Lou Wise

erosion simultaneously, representing a significant, detrimental impact on stream aquatic life. It will be important to focus on erosion prevention: first, by phasing topsoil stripping in each subwatershed to limit the extent of exposed soil at a given time and second, by stabilizing soils as soon as possible.

Another key issue is the proper installation, inspection and maintenance of erosion and sediment controls and site restoration. Municipalities should review and strengthen where necessary their bylaws regulating land disturbance (e.g., Site Alteration, Fill, Topsoil, Erosion and Sediment Control Bylaws and Subdivision Agreements). They should also undertake increased inspection and enforcement in partnership with TRCA's Enforcement Officers. The Greater Golden Horseshoe Area Conservation Authorities' *Erosion and Sediment Control Guidelines for Urban Construction* provides additional guidance and should be implemented.

Recommendations

14. Adopt and implement the Greater Golden Horseshoe Conservation Authorities' *Erosion and Sediment Control Guidelines for Urban Construction* (2006).

15. Adopt policies that phase topsoil stripping to smaller areas and require site stabilization as soon as possible.

16. Improve control of land disturbance
    - Review and strengthen where necessary bylaws regulating land disturbance.
    - Restrict topsoil stripping until draft plan approval.
    - Increase inspection and enforcement of bylaws regulating land disturbance.

17. Conduct regular training seminars for municipal and CA staff, consultants, and contractors to promote awareness of best practices and application and testing of innovative, environmentally-friendly products for erosion control and site restoration.

18. Improve site maintenance and restoration during and following construction.

19. Adopt a policy requiring replacement of an optimum depth of topsoil to maintain or increase pre-development infiltration capacity and to provide a suitable environment for restoring vegetation, based on stormwater management and vegetation cover targets.

20. Require use of native species in site restoration planting plans and require sign-off by qualified professional on "as-installed" site conditions.

21. Enforce requirements for post-construction monitoring and replacement of stabilization measures until sites are restored as planned.

Lead responsibility: Municipalities
Other partners: TRCA, developers

Strategy 5. Implement stormwater retrofits

Stormwater retrofit

Installation of new stormwater management measures or upgrades to existing infrastructure at the lot level, conveyance system or at end-of-pipe, in order to improve the level of stormwater management.

The modelling and analysis undertaken in preparing this plan predicted that implementation of the comprehensive City of Toronto *Wet Weather Flow Management Plan* would provide significant benefits by reducing pollutant concentrations, erosion potential and risk of flooding. Undertaking the stormwater retrofits identified in studies prepared by the City of Brampton, Town of Richmond Hill, the City of Vaughan, and the Town of Caledon would also help reduce pollutant concentrations, with less benefit in terms of erosion potential. As a first step in implementing stormwater retrofits, stormwater management master plans like the City of Toronto's *Wet Weather Flow Management Plan* should be prepared at subwatershed scales. In The City of Brampton, Town of Richmond Hill and the Town of Caledon, end-of-pipe retrofits should be implemented as opportunities arise, such as during redevelopment or stormwater pond maintenance initiatives or road or park redevelopment projects.

The Town of Richmond Hill has been monitoring the performance of many of its existing stormwater management ponds and identifying "re-commissioning opportunities" through minor modifications that could optimize their performance with respect to water quality and erosion control. Similar programs should be formalized by all other local municipalities in the watershed, as part of municipal stormwater infrastructure maintenance programs.

Lot level and conveyance measures should be implemented where possible in existing urban areas to reduce surface runoff and achieve greater retention of water on site, through infiltration and evapotranspiration. It is generally preferable to emphasize infiltration over evapotranspiration, especially in important recharge areas. Innovative technologies will be needed to achieve infiltration, such as "third pipe" exfiltration systems or "clean water collectors" and engineered infiltration trenches and swales. In some areas with low infiltration capacity, it will be more effective to emphasize evapotranspiration (e.g., rain gardens and green roofs) or rainwater harvesting.

The Province and municipalities should continue to develop and implement revised municipal community design and engineering standards and ensure that they allow adequate flexibility to meet stormwater management objectives.

The *Action Plan for Sustainable Practices* developed by Freeman Associates (see box) should be implemented to dispel myths about sustainable water practices and naturalized landscaping and provide positive examples, information and incentives to landowners.

Recommendations

22. Continue to implement improvements to stormwater management systems as described in the City of Toronto's *Wet Weather Flow Management Plan*.

23. Retrofit existing urban areas with improved lot level, conveyance and end-of-pipe stormwater controls
    - Give priority to retrofits in the highly urbanized Black Creek and Lower Humber subwatersheds, particularly in combined sewer areas, and rapidly urbanizing Rainbow Creek subwatershed (the City of Toronto and the City of Vaughan).
    - Emphasize exfiltration, evapotranspiration and rainwater harvesting technologies in areas of low soil permeability (e.g., West Humber, Rainbow Creek, and Purpleville Creek subwatersheds).
    - Emphasize infiltration over evapotranspiration where local recharge to groundwater provides a significant portion of baseflow and is critical to maintain aquatic habitats (e.g., Centreville Creek, Cold Creek, and upper East Humber subwatersheds).
    - Landscape residential, commercial, industrial and institutional properties with native plants, create rain gardens and harvest rainwater from rooftops for non-potable uses.
    - Implement identified end-of-pipe retrofits in The City of Brampton, the Town of Richmond Hill and the Town of Caledon as opportunities arise through redevelopment or facility maintenance initiatives.

SOCIAL MARKETING OPPORTUNITIES FOR SUSTAINABLE PRACTICES

Two recent studies provide valuable insights into the design and likelihood of success of programs to encourage naturalization and lot level stormwater management by businesses and the public. They are the *Action Plan for Sustainable Practices in the GTA* – residential and businesses - by Freeman Associates and the Canadian New Home Builder Customer Satisfaction Study by J.D. Power and Associates.

Key findings of these studies:

RESIDENTIAL

GTA homeowners' landscapes are viewed as an extension of their homes and themselves. A key barrier to adoption of sustainable practices for landscape design and maintenance is that homeowners have a deeply held landscape aesthetic (manicured, colourful, tidy, designed) that they do not associate with a "naturalized" landscape. However, when shown photographs of examples of naturalized landscapes and lot level stormwater infiltration methods, most people found them attractive and 84 per cent were willing to consider changes to their home landscape. 46 per cent of new home buyers would accept a low maintenance landscaping package requiring less water and fertilizer use if offered by the builder. Landscape professionals, nurseries, garden centres and large stores such as Home Depot and Canadian Tire are key trusted advisors for garden design and purchase of plants and products.

BUSINESS

There are opportunities associated with the growing environmental ethos penetrating business and government decision-making. Energy efficiency and the reduction of water use and wastes are growing priorities, and green building design is gaining acceptance. Innovative stormwater management and naturalized landscapes receive much less attention. There are regulatory, financial, information and technical barriers that should be addressed with a multi-faceted, regional strategy.

24. Implement measures to increase uptake of sustainable approaches to stormwater management, based on the Action Plan for Sustainable Practices, Freeman Associates, 2006
    - A multi-pronged marketing campaign in the GTA promoting native plant landscaping, rain gardens and pollution prevention practices. Components could include a poster campaign, advertising in community newspapers, direct mailings, point of purchase displays, workshops, demonstration projects, tours and garden competitions.
    - Financial incentives to property owners for implementing lot level stormwater retrofits, such as no-interest loans and grant programs
    - Information tools such as a guide book, workshop, demonstration projects and email advice ("ask an expert")
    - Awards program to recognize exemplary work

Lead responsibility: TRCA, municipalities
Other partners: Province, developers, property owners

Strategy 6. Maintain stormwater infrastructure

There are approximately 216 stormwater management ponds in the Humber, many of which have been in place for several decades and likely need to be cleaned out (sediments removed) so that they continue to help control of flooding, water quality and erosion. Failure to do so could exacerbate or create new erosion and water quality problems. Opportunities to make minor modifications to improve performance should be investigated. Other stormwater infrastructure facilities, such as catch basins, swales and oil/grit separators, also need maintenance to ensure that they function as effectively as possible.

Recommendations

25. Continue to develop and implement operation and maintenance programs for stormwater management infrastructure (ponds, catch basins, swales, oil/grit separators and retrofit projects).

26. Formalize programs to monitor the performance of existing stormwater management ponds and identify "recommissioning opportunities" through minor modifications that could optimize their performance with respect to water quality and erosion control.

27. Investigate innovative financing mechanisms for stormwater infrastructure maintenance and upgrades/retrofits, such as
    - Stormwater infrastructure user fees, associated with the municipal water and sewer bill, calculated by the quantity of impervious area on a property
    - Credits for property owners who undertake good stormwater management practices.

Lead responsibility: Municipalities
Other partners: Property owners

Stormwater management ponds need periodic maintenance to maintain performance.
Photography by Town of Richmond Hill

Strategy 7. Prevent pollution

The first line of defence against pollutants is always pollution prevention. For example, in developing the sustainable community scenario, it was assumed that there would be a 10 per cent reduction in pollution generated from fertilizers, pesticides, metals, and suspended solids, and 30 per cent reductions in chloride from careful management of road de-icing. In addition, lot level retrofits to retain water on individual properties will reduce the conveyance of pollutants to streams and rivers.

To accomplish these improvements, there is a need to develop, communicate and enforce bylaws and regulations to control use, storage and management of potential pollutants. This will require co-ordinated actions by the Province and municipalities.

In addition to the actions listed below, the preparation of drinking water source protection plans will help to ensure protection for the quality of groundwater-based water supplies. They are expected to provide direction with regard to appropriate stormwater management measures and technologies within wellhead protection zones.

Recommendations

28. The Province should
    - Develop provincial guidelines for inland fill operations to ensure acceptable fill quality and location.
    - Adopt ecological policy, criteria and guidelines that address water temperatures and chloride.
    - Continue to develop and implement a rural water quality stewardship program to address priority contaminant sources and support nutrient management standards under the *Nutrient Management Act*.

Key Elements of the Nutrient Management Act

- Riparian corridor and natural heritage protection and rehabilitation
- Best management practices for rural land uses
- Establishment of local clean water advisory committees with mandate to oversee the implementation of rural water quality improvements. Progress will be reported to local and regional municipalities.
- Public agency leadership in addressing rural water quality improvements (major landowners, the Federal and Provincial Governments and TRCA should demonstrate opportunities for improvement on their own lands)
- Reclamation of wetlands to retain nutrients and prevent soil erosion

29. Municipalities should
    - Develop monitoring programs to track the amount, timing and distribution of road salt applications.
    - Implement and review snow disposal and road salt management plans.
    - Train staff about spill prevention, control and response procedures.
    - Adopt bylaws limiting the cosmetic use of pesticides on public and private lands (the Town of Caledon and the City of Toronto have already done this).
    - Promote education and awareness programs about pollution prevention, such as Yellow Fish Road and Healthy Yards, in cooperation with TRCA and other community partner groups.
    - Naturalize stormwater ponds to discourage use by Canada geese and provide educational signage advising the public not to feed the geese.
    - Retrofit stormwater ponds to provide water quality and erosion control as opportunities arise.
    - Ensure that sewer use by-laws are up to date including application to storm sewers and regional roads, requirements for the preparation of pollution prevention plans, and provisions for the establishment of an inspection program.
    - Establish integrated pesticide management (IPM) programs for golf courses and cemeteries.
    - Promote the use of hazardous waste drop-off centres.

Lead responsibility: Province, municipalities, landowners
Other partners: TRCA

Strategy 8. Manage flood risks

Flood risk management is achieved through various means including planning and development legislation and municipal programs such as infrastructure improvements. Under the *Planning Act*, municipalities must be consistent in their land use decisions with the Natural Hazards policies of the *Provincial Policy Statement* (PPS) to ensure that any new development is directed away from areas where there is an unacceptable risk to public health, safety or property damage. Complementary to the PPS, TRCA administers the *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation* (Ontario Regulation 166/06 under the *Conservation Authorities Act*) and TRCA's Valley and Stream Corridor Management Program.

The historic settlements in Woodbridge (the City of Vaughan), Bolton (the Town of Caledon), Oak Ridges (the Town of Richmond Hill) and in the vicinity of Jane Street and Wilson Avenue (the City of Toronto) and Weston Road and Black Creek (the City of Toronto) are located within the regional storm flood plain of the Humber River and were established prior to the implementation of a Provincial flood plain planning policy. Through the provisions of the PPS, the Ministers of Natural Resources (MNR) and Municipal Affairs and Housing (MMAH) designated these areas as Special Policy Areas (SPAs). Any change within the SPA, above and beyond what has already been approved by the Province, must be supported by both the MMAH and MNR based on a comprehensive risk assessment plan. To be sustainable, these areas must be disaster resilient. The challenge will be to balance the need to accommodate an increasing population in a sustainable way, and to do so in a way that manages the risks that relate to flooding.

It will also be necessary to evaluate the effects of development beyond the existing official plan designations and the potential to increase the frequency and severity of flooding, particularly

within existing flood prone areas. Regular review of flood plain modelling assumptions that trigger new updates to flood plain mapping is required to ensure flood hazards are accounted for and to confirm appropriate stormwater management controls are implemented as growth proceeds.

To further inform municipal growth management and new development, advancements in the prediction of regional and local climate change should be tracked, and impacts on local flood risk assessed, so that local stormwater and flood plain management approaches can be modified as required. This is especially important given the anticipated increase in the intensity and severity of storms due to climate change that could affect peak flows and related flood risk.

Recommendations

30. Toronto and Region Conservation should
    - Work with the Province, municipalities and developers to reconcile the conflict inherent in intensifying development in flood prone areas through flood risk assessment plans, flood remediation and flood proofing measures, as well as seeking opportunities for intensification outside the flood plain.
    - Use recommendations from the on-going study of flood vulnerable areas and roads in the Humber Watershed, in support of TRCA's Flood Protection and Remedial Capital Works Prioritization Project (see box), to prioritize flood remediation work over the next ten years.
    - Continue to operate and enhance the flood forecasting and warning program.
    - Continue to develop the real time precipitation and stream gauge network for use in TRCA's Flood Warning Program.
    - Seek federal and provincial funding to track advancements in the prediction of regional and local climate change (e.g., predicting change to frequency and severity of extreme storm events and downscaling of data from global climate models for use at the watershed or regional scale). Assess impacts on local flood risk so that local stormwater and flood plain management approaches can be modified as required.
    - Continue to maintain and update flood plain mapping and the flood vulnerable site database to assist municipal emergency response.
    - Educate homeowners regarding flood risks associated with improper practices such as backyard dumping and impediments to water movement.
    - Restore natural cover in drainage areas upstream of flood vulnerable areas to help attenuate flood flows (e.g., no mow zones, riparian plantings, grass swales).

Toronto and Region Conservation Flood Protection and Remedial Capital Works Prioritization Project

This project assesses the risk to life and property at existing flood prone sites, including numerous structures in existing Special Policy Areas. The assessment will utilize updated hydraulic modelling and flood vulnerable sites databases. Following the risk assessment, an initial assessment of the types and extent of flood protection works which could be undertaken to either minimize or eliminate risk of flooding will be completed for each site. A preliminary cost/benefit analysis for each site will then be done to prioritize sites for remedial work.

The Humber River will be the first TRCA watershed to be assessed as the modelling and databases required were recently updated.

31. Municipalities should
    - Undertake comprehensive flood risk assessment plans to define how additional flood risk created through proposed land use changes in Special Policy Areas can be managed.

- Undertake an updated hydrologic study to evaluate the effects on flooding of proposed new developments and to confirm the level of stormwater control needed before expanding urban settlement boundaries beyond those identified in existing official plans.
- Develop or update flood emergency response plans.
- Incorporate opportunities to remediate flood vulnerable roads or sites when designing infrastructure improvements to service new growth or redevelopment, such as watercourse crossings.

Lead responsibility: Province, TRCA, municipalities
Other partners: Federal government

Strategy 9. Protect stream form

The protection of streams from erosion and sedimentation was addressed in the strategies above regarding recharge, natural cover, development design and stormwater management.

In addition, a number of legislative and regulatory tools exist to protect natural stream form as part of the natural heritage system. They include TRCA's Valley and Stream Corridor Management Program and Ontario Regulation 166/06, municipal official plan policies, the *Fisheries Act*, the *Oak Ridges Moraine Conservation Plan*, the *Greenbelt Plan*, and the *Niagara Escarpment Plan*.

Protection of the hydrologic and fish habitat functions of headwater drainage features is believed to be essential to watershed integrity. The Department of Fisheries and Oceans, conservation authorities and municipal staff should continue to work in partnership to apply interim guidelines to assess the function and appropriate treatment of these features through the development planning process and refine them, if necessary, based on practical experiences (see box).

Evaluation, Classification and Management of Headwater Drainage Features – Interim Guidelines, TRCA, CVC and DFO, March 2007

Rural and urban development activities may impact or eliminate headwater drainage features. These features may provide seasonal or contributing fish habitat and recharge functions such that alterations to them may have implications on watershed ecological integrity. These interim guidelines are intended to be used by developers and their consultants and conservation authority staff in the preparation and review of development studies and applications as a comparative evaluation tool for considering the integrative nature of flow, channel form, and vegetation with regard to fish habitat and the hydrologic functions of headwater drainage features.

When rivers and streams move across their flood plains, they may expose infrastructure that is located in valley corridors to risk of damage or failure (e.g., bridge abutments, water mains, sanitary sewers, natural gas pipelines, trails). Large floods can accelerate this process, creating the need for immediate emergency projects that do not allow adequate time for planning. As further discussed in Section 5.5.1, planning for new infrastructure should avoid placing infrastructure in valleys in order to allow room for natural movement of the channel across the flood plain.

In addition, municipalities and other agencies should maintain an inventory of "at-risk" infrastructure and conduct regular monitoring of these sites, so that they can initiate proactive planning for remediation projects. These projects should incorporate opportunities for net gain in achieving objectives of this Watershed Plan.

Recommendations

32. Protect natural stream form, using TRCA's Valley and Stream Corridor Management Program and *Ontario Regulation 166/06*, municipal official plan policies, the *Fisheries Act*, the *Oak Ridges Moraine Conservation Plan*, the *Greenbelt Plan*, and the *Niagara Escarpment Plan*.

33. DFO, conservation authorities and municipalities should complete scientific evaluations and continue to work in partnership to apply interim guidelines for assessing the function and appropriate treatment of headwater drainage features through the development planning process and refine them where necessary.

34. Investigate opportunities to acquire lands in strategic locations to allow stream corridors to evolve naturally, without affecting property or infrastructure.

35. Road crossings over watercourses should be sited at appropriate locations (e.g., not on a meander) to minimize potential for alterations to channel form and allow for natural movement of the channel within the flood plain.

36. Planning for new infrastructure should avoid placing infrastructure (e.g., storm pond outfalls) in valleys in order to allow room for natural movement of the channel across the flood plain and avoid or reduce channel lowering when it is necessary.

37. Maintain an inventory of "at-risk" infrastructure, conduct regular monitoring and undertake proactive planning for remediation projects incorporating opportunities for net gain in achieving objectives of this Watershed Plan.

Lead responsibility: Municipalities, TRCA, utilities
Other partners: Province, federal government

Strategy 10. Monitor, evaluate and adjust

It is important to monitor the effects of new and retrofitted urban development design and stormwater management practices to provide a basis for adaptive management.

The Regional Watershed Monitoring Program (RWMP), led by TRCA in partnership with its member municipalities and other monitoring groups, provides a substantial information base for the Humber watershed. The RWMP was developed based on regional and watershed scales, and to the extent possible, the subwatershed scale. During the preparation of this plan, it was found that additional information is needed at both the watershed and subwatershed scales to fully understand systems in the Humber watershed.

In addition, TRCA's Sustainable Technologies Evaluation Program (STEP) provides a valuable forum for co-ordinated performance monitoring and evaluation among a number of agencies and private partners.

Sustainable Technologies Evaluation Program
www.sustainabletechnologies.ca

Recommendations

38. Monitor the effects of new and retrofitted urban development design and stormwater management practices and implement adaptive management where necessary, including
    - Require developers to undertake or contribute to compliance monitoring and enforcement to ensure approved stormwater management facility design performance targets are met.
    - Conduct monitoring studies at the site and subwatershed scales to determine the extent to which community design standards and innovative stormwater management practices mitigate the cumulative effects of urban development on water balance and aquatic systems.
    - Identify indicators, establish baselines and set targets for a natural range of variation of stream flow.
    - Evaluate all the effects of new and retrofitted stormwater management practices on baseflow and revise the management recommendations and criteria of this plan as necessary.
    - Adopt modified management strategies, criteria and guidelines, as necessary.

39. Continue the existing Regional Watershed Monitoring Program (RWMP), with specific enhancements as listed in the *Humber River Watershed Plan Implementation Guide*.

40. Test, evaluate and promote innovative approaches and technologies using the Sustainable Technologies Evaluation Program (STEP)
    - Develop policies, guidelines and design standards/specifications for new technologies such as green roofs and permeable pavement, and assess barriers to implementation.
    - Arrange for third-party verification of technology performance.
    - Implement and evaluate innovative technologies using pilot projects.
    - Communicate results through seminars and publications.

Objectives of the Sustainable Technologies Evaluation Program (STEP):

- Monitor and evaluate sustainable technologies in the areas of water and air
- Assess potential barriers to implementing sustainable technologies
- Provide recommendations for guideline and policy development
- Disseminate study results and recommendations and promote the use of effective technologies at a broader scale through education and advocacy

www.sustainabletechnologies.ca

Lead responsibility: TRCA, municipalities, MNR, Environment Canada
Other partners: Province, federal government, Greater Toronto Home Builders Association-Urban Development Institute, developers and their consultants, utilities, NGOs, private landowners.

5.3.2 AIR QUALITY AND CLIMATE CHANGE

Objective

- Reduce air pollution to levels that protect human health, natural ecosystems and crops, and do not exacerbate global climate change

Air quality in the Humber watershed is similar to that of other parts of the GTA and is influenced by emissions associated with transportation of people and goods, industrial activities, and heating and cooling of buildings, not only in the watershed but also elsewhere in the region and further away in the United States. Current development patterns and population densities in much of the watershed do not support development of rapid transit and instead encourage dependency on private automobile use, contributing to poor air quality and greenhouse gas emissions. Actions taken in the watershed to reduce air pollution and use of fossil fuels will make a valuable contribution both locally and regionally.

The review of current conditions in Chapter 3 highlighted the following key issues:

- Increasing ground-level ozone levels and number of smog days
- Impacts of air pollution on the health of humans, crops, plants and animals
- Increasing greenhouse gas emissions contribute to global climate change
- Potential effects of climate change on ecosystem characteristics and functions, public safety (flooding) and public health

Current Initiatives

The Clean Air Partnership has produced *A Model Clean Air Plan for the Living City*, with support from TRCA and the federal government. The report includes a broad spectrum of possible actions to help municipalities develop clean air plans.

The GTA Clean Air Council was formed in 2001 to work on air quality issues. Once a year, the Council holds a Smog Summit to review progress on efforts to reduce air pollution. During the 2006 Summit, the municipalities of Toronto, Mississauga, Brampton, Vaughan, Caledon, King, Richmond Hill, and the regional municipalities of Peel and York were among those who signed the Intergovernmental Declaration on Clean Air.

The GTA Clean Air Council maintains updated information about the air quality initiatives of GTA municipalities on its web site (**www.gtacleanaironline.ca**) under the themes of transportation, energy, business, industry and government (e.g., fleet management, employee incentive programs), natural environment, and education. All the Humber watershed municipalities are engaged in activities to reduce smog and greenhouse gas emissions.

York Region's VIVA rapid transit system.
Photo used with permission from York Region.

Urban tree canopy helps combat the urban heat island effect and mitigate impacts from climate change.
Photography by Lou Wise

Selected examples include:

- The Regional Municipality of Peel is developing a policy on emission trading credits.
- The Regional Municipality of York launched Viva in 2005, the first rapid transit bus service of its kind in the GTA. They are also leading a smart commute initiative for employees.
- The City of Vaughan has a partnership with Smart Commute Association of Black Creek to encourage alternative transportation.
- Township of King is reviewing a proposed Open Air Burning By-law.
- The Town of Caledon has a COOL Caledon Community Task Force working on a tree planting program and light bulb efficiency project.
- The City of Brampton is developing a marketing plan for public transit.
- The City of Mississauga approved a City Clean Air Strategy with several programs to reduce smog and greenhouse gas emissions.
- The Town of Richmond Hill is implementing a Town Clean Air Initiatives Local Action Plan to reduce greenhouse gases.
- The City of Toronto set up the Toronto Atmospheric Fund to provide grants and loans for initiatives that lead to significant emission reductions.

Toronto and Region Conservation's (TRCA) air quality and greenhouse gas initiatives include: a commitment to increase use of "green" electricity at all of its facilities; smog day policy requiring that activities such as use of two stroke motors, painting, etc., not be performed during a smog advisory; and installation of an air biofiltration system or "breathing wall" at Head Office along with a new energy efficient HVAC system. The Living City Campus at Kortright is home to the largest alternative energy demonstration in Canada and conducts many workshops on renewable energy. As part of development of the Living City Campus, a number of new programs aimed at encouraging GTA-wide energy conservation and efficiency have been initiated (e.g., Mayor's Megawatt Challenge, Greening Health Care, Greening Retail, Sustainable Schools).

Bullfrog Power (**www.bullfrogpower.com**) provides residents, institutions and businesses in the Humber watershed, as elsewhere in Ontario, with the opportunity to purchase 100 per cent green electricity from producers who meet or exceed the federal government's EcoLogo standard for renewable energy.

Strategies

To improve air quality and reduce greenhouse gas emissions, we recommend the following strategies

1) Reduce vehicle use and other emissions.
2) Enhance natural vegetation sinks.
3) Undertake a vegetation impacts study.

Urban Transit

A single urban transit vehicle can save 70,000 litres of fuel and keep nine tonnes of pollutants out of the air each year (*York Region Transportation and Works Newsletter*, 2004, Vol.5).

Strategy 1. Reduce vehicle use and other emissions

We recommend more sustainable approaches to urban form and transportation that include measures to reduce vehicle use and to encourage clean, renewable forms of energy generation and district energy schemes.

Recommendations

See Section 5.5.1 on Urban Land Use.

Strategy 2. Enhance natural vegetation sinks

Vegetation can take up considerable amounts of carbon dioxide, thereby reducing the concentrations of greenhouse gases in the air. Plants also trap particulates and other airborne pollutants. The urban tree canopy helps combat the urban heat island effect. To achieve these benefits, we recommend the strategies to secure, restore and enhance natural cover that are identified in Section 5.3.4 on the Terrestrial System.

Recommendations

See Section 5.3.4 on the Terrestrial System.

41. Undertake region-wide urban tree canopy studies to assess current conditions using consistent methods, set targets and develop a strategy to maximize the benefits of urban tree planting.

42. Increase soil volume in street tree planters to improve tree growth.

43. Municipalities and NGOs should continue to offer free native trees and shrubs and planting services to private landowners in urban areas lacking tree cover or where trees are nearing the end of their lifespan (e.g., the City of Toronto's Urban Forestry Program and the Local Enhancement and Appreciation of Forests (LEAF) initiative.

Strategy 3. Undertake a vegetation impacts study

We recommend a GTA-wide study to assess the economic and ecological impacts of poor air quality on local agricultural crops, urban forests and natural heritage.

Recommendation

44. TRCA should convene a committee of government, agency and other researchers to develop a study proposal and seek funding for a vegetation impacts study.

Lead responsibility: TRCA
Other partners: Universities, municipalities, regional federations of agriculture, MOE, MNR, Environment Canada, NGOs.

5.3.3 AQUATIC SYSTEM

Objectives

- Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species
- Provide for sustainable fishing opportunities and the safe consumption of fish

The aquatic system includes the physical and chemical conditions as well as the communities of fish, invertebrates and other animals and plants that live in the streams, rivers and wetlands of the Humber watershed. Its health is highly dependant on the status of other elements of the watershed, especially the water cycle and natural cover.

The review of current conditions in the watershed showed that there is still high ecological function in the headwaters and upper reaches of the Main Humber, which are characterized by cold water habitats. Cool water habitats that currently support redside dace, a species at risk, occur further downstream in the middle reaches. The lower Main Humber, Black Creek and Rainbow Creek have warm water conditions that have been degraded to varying degrees by urbanization. The review of current conditions in Chapter 3 highlighted the following issues:

- Generally poor quality aquatic habitats in most urban areas and some rural areas
- Sensitivity of many specialized aquatic species to impacts of urbanization
- Populations of redside dace are in decline and will be further affected by urban growth in the East and West Humber subwatersheds
- Sustained loss and risk of further loss of native aquatic species due to declining habitat and competition with invasive species
- Invasive non-native aquatic species
- Fragmented stretches of riparian vegetation
- Numerous in-stream barriers
- Fish consumption advisories

Looking ahead to potential future conditions, analysis shows that conventional urban development would result in deterioration of aquatic communities, with the likely loss of cool water fisheries and considerable reductions in species diversity. Enhanced natural cover will mitigate many of these impacts, but additional measures such as lot level and conveyance stormwater management measures are needed to maintain and improve current conditions.

Current Initiatives

Groups such as Ontario Streams, Trout Unlimited and the Black Creek Project undertake riparian planting and stream restoration projects that help to improve aquatic habitats by increasing shading, improving physical structure, and reducing runoff, erosion and siltation. The Town of Richmond Hill's Lake Wilcox Shoreline Restoration Project is helping to restore shoreline habitats on public and private properties.

In-stream barriers have been modified in the City of Toronto, Woodbridge, Palgrave, Bolton and Albion Hills Conservation Area to improve fish passage. An environmental assessment has been completed by Ontario Streams and Ontario Ministry of Natural Resources (MNR) for improvements to fish passage in the Lower Humber while controlling the migration of invasive species such as sea lamprey.

Clock wise from left: Brook trout (Permission for use granted by the Ontario Ministry of Natural Resources); *Rainbow Trout* (Illustration Virgil Beck, Wisconsin Department of Natural Resources, used with permission from the Ontario Ministry of Natural Resources); *Redside dace* (Illustration by Ellen Edmonson and Hugh Chrisp, used with permission from the New York State Department of Environmental Conservation); *Rainbow darter* (Illustration by Ellen Edmonson and Hugh Chrisp, used with permission from the New York State Department of Environmental Conservation).

Since 2000, MNR has stocked the Humber River with over 563,000 fish including brown trout, chinook salmon, coho salmon, rainbow trout and walleye. Chaminade College School, in partnership with Ontario Streams and MNR, has been successfully hatching and releasing brown trout into Black Creek.

The Greater Toronto Area Recreational Fishing Committee is encouraging and coordinating increased participation in environmentally sustainable recreational urban fishing. MNR has improved the enforcement of fishing restrictions near the Old Mill weir in the Lower Humber. MNR, the City of Toronto and TRCA recently partnered with Bob Izumi to produce a television episode of Bob Izumi's Real Fishing Show: Fishing Around Toronto. The Urban Adventure.

Strategies

A *Humber River Fisheries Management Plan* has been developed by the Ontario Ministry of Natural Resources and TRCA (2005). The plan characterizes the existing conditions of seven aquatic habitat types found in the watershed and assesses their habitat potential. It addresses, at a watershed scale, accessibility of public lands, protection of species of conservation concern, management of consumptive uses such as harvesting of baitfish, fish stocking, angling regulations, fish viewing and related education activities. Specific management directions and rehabilitation priorities are provided for the five primary subwatersheds.

The *Humber River Fisheries Management Plan* identifies target fish species for management: brook trout, redside dace, rainbow trout, brown trout, Atlantic salmon and darters. Management in support of these target species will provide conditions that are suitable for other species that require stable, cold or cool water habitats. This management approach is continued in this Watershed Plan, with emphasis on brook trout, rainbow trout, rainbow darter and redside dace (the latter because of its status as provincially endangered). A draft Redside Dace Recovery Plan co-ordinated by MNR is providing new ecological management considerations (MNR, 2005).

Through the preparation of this Watershed Plan understanding of the aquatic system has been further developed, based on integration of information on physical and biological conditions. Twelve (12) Fish Management Zones (FMZ) have been delineated, recognizing the importance of evaluating fish communities in the context of a river continuum, where similar physiographic and hydrologic conditions give rise to habitats that support similar fish communities in a specific zone (see Figure 5–1).

The recommended approach to management of the aquatic system is based on the protection of the groundwater system, base flows and surface water flows, combined with implementation of a robust terrestrial natural heritage system with a strong riparian component. This will improve the diversity of species and habitats and help to buffer the expected effects of urbanization and climate change.

There are four priority management strategies for the aquatic system:

1. Maintain or restore natural stream flow patterns and protect aquatic habitats.
2. Optimize fish passage for native fish and stocked migratory species.
3. Support the Redside Dace Recovery Strategy.
4. Improve recreational fishing opportunities.

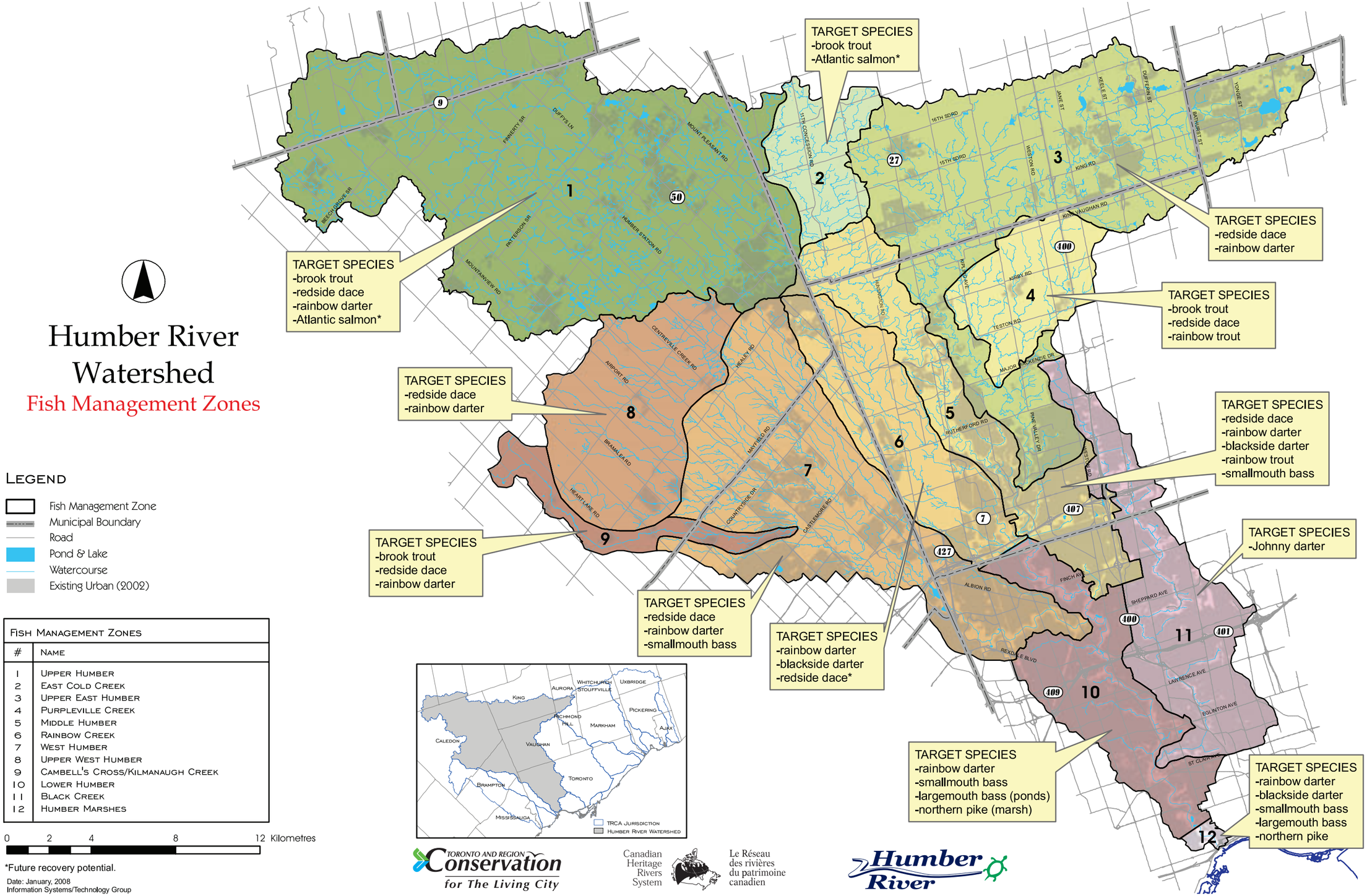
Strategy 1. Maintain or restore natural stream flow patterns and protect aquatic habitats

The most critical actions needed to protect, restore and enhance the health of the aquatic system are those that contribute to maintaining natural stream flow patterns through careful management of the water budget in new and existing developments. Natural stream flow patterns include fluctuations in the seasonal distribution of stream flow and contribution of groundwater discharge to low flow conditions.

Existing stream flow patterns in the headwaters of the Humber watershed (FMZs 1 and 3) still closely mimic flow patterns seen in relatively natural systems. Reforestation activities should be focused in the headwaters to anchor the substantial area of high quality stream habitat and help to mitigate cumulative impacts of urbanization in the middle and lower reaches of the watershed where there are fewer opportunities to plant trees.

In the middle reaches of the watershed, where most new development is expected to occur, enhanced tree cover in pervious areas will provide benefits, but will not be sufficient to off-set all stresses from urbanization such as changes in stream flow, water temperature and water quality. These reaches support highly sensitive aquatic communities, including populations of redside dace (see also Strategy 3 below), brook trout and rainbow darter. In these middle reaches, planning and design of new developments needs to consider the sensitivities of target fish species and include management measures that aim to maintain pre-development water budget, which will help to maintain natural stream flow patterns. Construction activities will need to be appropriately scheduled to avoid spawning periods when target species are most sensitive. Given that groundwater discharge to the middle reaches appears to flow from the Oak Ridges Aquifer and associated recharge areas, there is little concern about the effects of local reductions in groundwater recharge on these reaches. However, increases in surface runoff would be harmful to the aquatic system and should be avoided or managed effectively. The low permeability of the soils in these areas suggests that the focus of stormwater management in the middle reaches should be on engineered infiltration measures, increasing evapotranspiration

Figure 5–1: Fish management zones



(e.g., tree planting and green roofs) and abstraction (e.g., rain harvesting). In addition, subsurface infrastructure should not be installed in the valleys to avoid shallow groundwater being diverted from the streams along the pathway of buried pipes. Where this is unavoidable, anti-seepage collars should be installed.

Some of the lower reaches of the watershed (e.g., FMZ 11) have already lost sensitive species such as the rainbow darter. Monitoring of the continued presence or decline of this species should continue because its disappearance in other reaches would be an early warning signal for development stresses that could be expected to affect other species. The greatest benefits for the aquatic community in the lower reaches of the watershed will result from stormwater retrofits, tree planting and the application of sustainable community technologies (e.g., rain gardens, rain harvesting, porous paving, green roofs, etc.) in existing and infill development.

Recommendations

45. In the headwaters and upper reaches of the Main and East Humber River (FMZ 1, 2 and 3), maintain or enhance existing ecosystem functions, particularly with respect to water balance with a focus on reforestation, and avoiding relocation of stream channels.

46. In the middle reaches (FMZ 4, 5, 6, 7 and 8), focus on protection and impact mitigation measures that maintain pre-development stream flow conditions as closely as possible and avoid relocation of stream channels. This should include increased tree cover (table land and riparian), restoration of wetlands on marginal agricultural land, and improved development practices to increase evapotranspiration and avoid increases in surface water runoff. Priorities include
    - Focus on maintaining and enhancing brook trout and redside dace habitat in Purpleville Creek (FMZ 4).
    - In the Lower West Humber (FMZ 7), maintain and enhance habitat for redside dace and potentially brassy minnow, sand shiner, pearl dace and freshwater mussels, through restoration of riparian wetlands and meadows along the small tributaries.

47. In the lower reaches (FMZ 10 and 11), implement stormwater retrofits, tree planting and sustainable community technologies (e.g., rain gardens, rain harvesting, porous paving, green roofs) to achieve more natural surface flow patterns and improve aquatic habitats.

Lead responsibility: TRCA, municipalities, developers
Other partners: Province, NGOs, private landowners

Strategy 2. Optimize fish passage for native fish and stocked migratory species

Continued improvements for fish passage are a high priority for the lower Humber River, however they must be undertaken with care in order to avoid also providing access for non-native invasive species such as sea lamprey and gobies that are presently not found above the Old Mill weir. Actions should also avoid increasing the risk of introducing new pathogens. Of particular concern is a new viral infection, Viral Hemorrhagic Septicemia (VHS) that has entered the Lake Ontario system, affecting baitfish and many other species, including salmonids. The MNR has produced guidelines designed to avoid spreading VHS further. They address hatchery management, stocking practices and fish transfers at fishways.

Weir on the main channel of the Humber River that is a high priority for modification to improve fish passage.
Photography by Dean Young

Recommendations

48. Implement the recommendations of the *Environmental Study Report for the Lower Humber Barrier Mitigation Project* (MNR, 2007). It recommends modifications to the eight existing in-stream barriers along the main channel in the City of Toronto. Operation of a new fishway near Old Mill should consider and take actions to prevent passage of non-native invasive species.

49. Conduct formalized in-stream barrier surveys to further prioritize mitigation work that would support healthier and more abundant populations of target and recreational fishing species.

50. Maintain the migratory route for target species (rainbow and brown trout) in FMZ 5.

51. Review management practices when guidelines for controlling the spread of the VHS virus are updated by MNR.

Lead responsibility: MNR, TRCA
Other partners: Municipalities, NGOs, private landowners

Strategy 3. Support the redside dace recovery strategy

The long-term goal of the recovery strategy is to protect and restore viable populations of redside dace in a significant portion of their historic range. Within Canada, this species most frequently occurs in Southern Ontario, with at least two relatively abundant populations in the Humber River. The recovery strategy summarizes the best available knowledge about the ecological requirements of this species and groups recommended management strategies for redside dace recovery in four categories: protection of existing populations and habitats; rehabilitation of degraded populations and habitats; research and monitoring; and community awareness and outreach.

Recommendations

52. Implement management actions to protect existing populations and habitats of redside dace
    - In areas identified in the *Humber River Fisheries Management Plan* as habitat for redside dace, adherence to the recommendations listed for minimum riparian buffer width in the *Redside Dace Recovery Strategy* (MNR, 2005) should be upheld. The highest level of protection between the two plans should be applied.
    - Apply findings from an intensive monitoring study being conducted in the Rouge River (2007) regarding urbanization impacts on streams supporting redside dace.

53. Monitor populations of redside dace in collaboration with the Redside Dace Recovery Team.

54. Increase collaborative efforts and communication amongst all agencies responsible for the protection and recovery of redside dace.

55. Engage the general public in stewardship and education about redside dace.

Lead responsibility: MNR
Other partners: TRCA, DFO, municipalities, NGOs, private landowners

Strategy 4. Improve recreational fishing opportunities

Atlantic salmon (Permission for use granted by the Ontario Ministry of Natural Resources)

The Humber watershed has been the focus of native, commercial and sport fishing harvest for centuries. Historically, Atlantic salmon, brook trout, bass and pike were harvested from the Humber River for food. Today, fishing in much of the River is primarily limited to recreational angling, with restrictions on consumption of Lake Ontario fish due to contamination by pesticides and heavy metals. In the coldwater streams and lakes of the headwaters, there are ample opportunities to harvest brown and brook trout, bass and pike with fewer concerns about contamination. The *Humber River Fisheries Management Plan* describes current regulations, stocking programs and baitfish harvest opportunities.

The Atlantic salmon was once an important part of the fish community of Lake Ontario and thrived in many tributaries, including the Humber River. However, by the mid 19th century, a resource that seemed limitless had all but vanished from the lake. Habitat loss and over fishing led to the extirpation of this native species, important for both its ecological role (as

top predator) and cultural significance (a highly valued resource). Recently, research and experimental stocking have laid the groundwork for a major new partnership between the Province and various partners to bring back the Atlantic salmon to Lake Ontario. The goal of the partnership is to restore wild (self-sustaining) populations of Atlantic salmon to Lake Ontario. Research has shown that young Atlantic salmon can grow and survive well in Lake Ontario tributaries today. Current efforts are focused on the Credit River, Duffins Creek and Cobourg Brook, with plans to undertake work in other tributaries, including the Humber River in the near future.

Recommendations

56. Support stocking of Atlantic salmon in the Humber watershed through the MNR Atlantic Salmon Recovery Program.

57. Continue to restore habitat and connectivity between Lake Ontario and the headwaters of the Humber River, particularly in the Town of Caledon.

58. Improve the amount and distribution of educational and regulatory signs about sustainable fishing opportunities on public land.

59. Continue to encourage anglers to adopt catch and release practices.

Lead responsibility: MNR, TRCA
Other partners: OFAH, Angling Groups (Winter Hatches, Trout Unlimited)

5.3.4 TERRESTRIAL SYSTEM

Objectives

- Protect, restore and enhance natural cover to improve connectivity, quality, biodiversity and ecological function
- Minimize negative influences from surrounding land uses on terrestrial natural heritage system quality and function

The terrestrial system includes forests, meadows, wetlands and beaches, along with the plants and animals that inhabit them. These natural systems provide many benefits that contribute to the health of the watershed. They help to maintain the water balance and stream stability, protect aquatic ecosystems, provide wildlife habitats, moderate climatic conditions, absorb air pollution, create recreation opportunities for people and generally improve the quality of life in our communities. The review of current conditions in the watershed highlighted some key issues:

- Poor quality of natural cover
- Existing natural cover patches are poorly connected, especially in the east-west directions
- Distribution of natural cover is weighted to the northern portions of the watershed
- Invasive species that threaten native ecosystems
- Impacts of human activities on plants, animals and their habitats

"More than 70 per cent of buyers of new homes in the GTA rate proximity to a park, common outdoor area or natural area as important or extremely important in their purchase decisions." J.D. Power Survey, 2006.

Looking ahead to possible future conditions, modelling work showed that the terrestrial system of the Humber watershed is at a crucial crossroad. Unless significant steps are taken to change the way our communities are developed and managed, the quality of the terrestrial system

will continue to decline in response to historical and current human impacts as well as future land use changes. Climate change will add further stresses to the system, resulting in probable losses of native species and increases in invasive, non-native species. The scenarios involving development according to existing official plans and "full build-out" to the boundaries of the Greenbelt and Oak Ridges Moraine are predicted to result in major declines in the quality of the terrestrial system and the biodiversity it supports.

The following approach is designed to improve terrestrial habitat conditions as well as to help offset the impacts of future development. It involves securing and restoring additional natural areas to increase the percentage of natural cover from the current 32 per cent to approximately 39 per cent of the watershed (Figure 5–2). This is the recommended amount to achieve the Watershed Plan objectives. It should be complemented by more sustainable practices in developed areas (e.g., increasing urban tree canopy, native plant landscaping, green roofs, etc.) in order to maintain current conditions as well as improve on them.

Caledon East wetland
Photography by Susan Robertson

Current Initiatives

Many tools are available to protect and manage the terrestrial system. They include the *Provincial Policy Statement, 2005*, *Greenbelt Plan*, *Oak Ridges Moraine Conservation Plan*, *Niagara Escarpment Plan*, municipal official plans and policies and TRCA's *Toronto and Region Terrestrial Natural Heritage System Strategy*. Toronto and Region Conservation (TRCA) completed the *Terrestrial Natural Heritage Strategy* to guide the protection, restoration and enhancement of the diversity and function of natural cover in all nine watersheds in its jurisdiction.

Many watershed municipalities have schedules in their official plans and zoning by-laws to protect the terrestrial system or are in the process of updating or incorporating natural heritage system planning as a part of growth planning initiatives. The City of Toronto, with input from TRCA, has identified policy and mapping for an expanded natural heritage system in its Official Plan. The City of Brampton, the Town of Caledon and the Regional Municipality of York have by-laws prohibiting the removal of woodlots. The City of Toronto, the City of Vaughan, the Town of Richmond Hill and the City of Mississauga have by-laws protecting trees on public and private properties, although enforcement remains a challenge, especially on private lands.

Many programs are available to assist landowners with restoring and managing natural cover on their properties. These include the Rural Clean Water Program, Canada-Ontario Environmental Farm Program, Oak Ridges Moraine Environmental Enhancement Fund, Greenbelt Farm Stewardship Program and TRCA's private land stewardship programs. The Regional Municipality of York has prepared a Greening Strategy that provides strategic direction regarding coordination and promotion of the Region's environmental initiatives.

Toronto and Region Conservation is undertaking restoration of wetlands and other natural areas under its *Humber River Watershed Habitat Implementation Plan*. For the last 10 years, TRCA has planted an average of 62 hectares of trees each year in the watershed. Rehabilitation plans have been developed for the Humber Marshes and Estuary (TRCA, 2003) and for wetlands

in the upper reaches of the watershed. Community groups are assisting with wetland restoration projects at Claireville Conservation Area and Seneca College's King Campus.

Toronto and Region Conservation, municipalities, schools, community groups and homeowners are improving natural vegetation cover through naturalization of schoolyard and parks as well as healthy yards initiatives (for an example, see **www.trca.on.ca/events/stewardship_programs/yards**).

Species recovery plans have been developed or are in progress for the Jefferson salamander, Acadian flycatcher, hooded warbler and least bittern.

Management guidelines for natural areas

- Ensure that native species and communities are at least maintained and restored where possible.
- Encourage natural disturbance dynamics, such as fire and flooding where possible.
- Accomplish restoration through natural succession without human intervention or with plantings of species and communities native to the Humber Watershed.
- Monitor and control the spread of invasive alien plant species. Involve the public where possible.
- Increase representation of upland communities and wetlands on table land.
- Restore and maximize connections between existing features and plan for species movement corridors with a focus on restoring west-east connections on tableland.
- Restore old fields and manicured areas to forest and wetland communities.
- Limit public access to sensitive areas and provide explanatory signage where appropriate.
- Design trail systems to avoid sensitive areas.
- Design restoration projects based on the specific physical conditions of the site and with flora and fauna diversity in mind.

Strategies

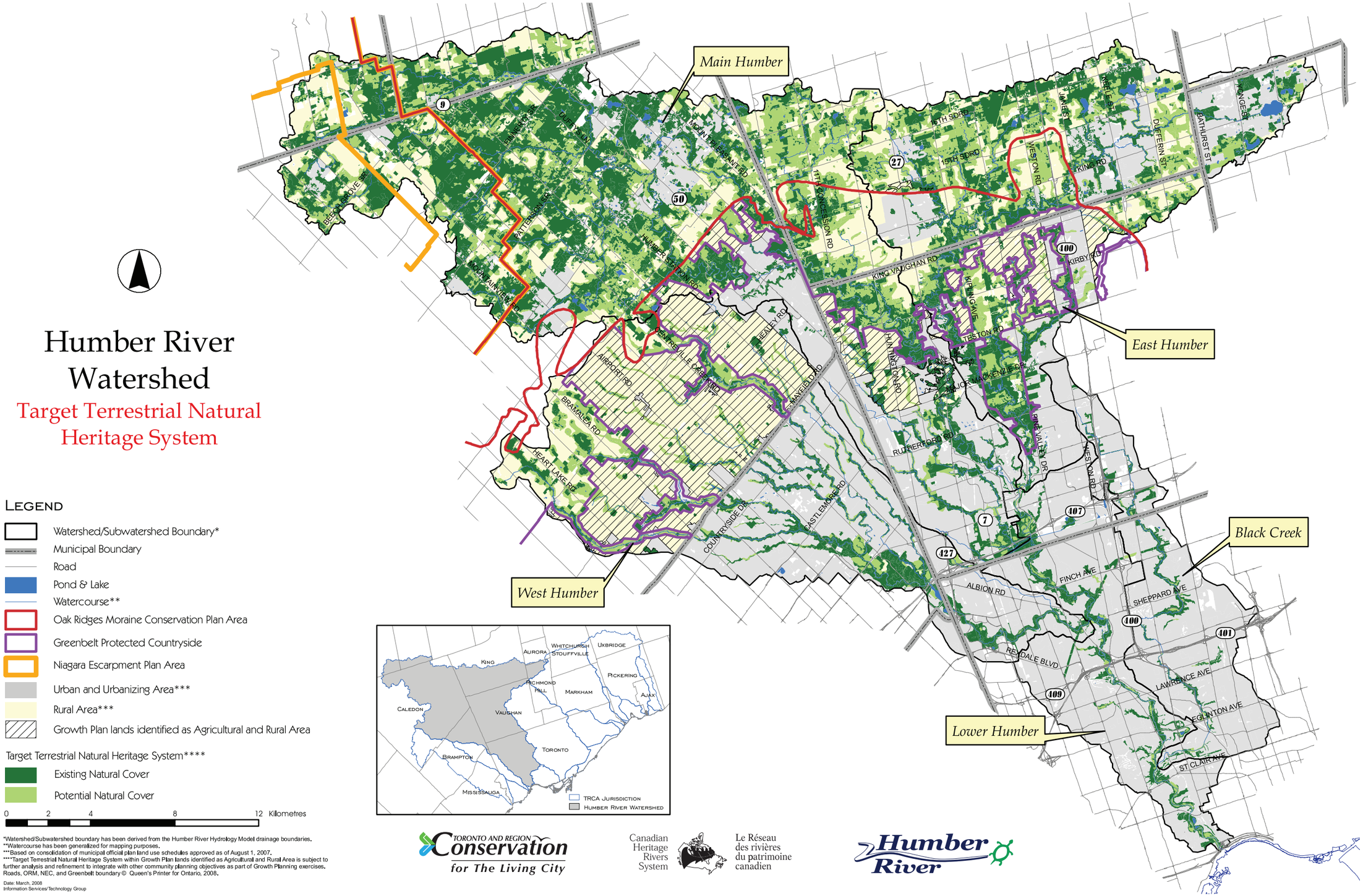
The analysis of current conditions and future scenarios showed that in order to maintain and improve ecological conditions in the watershed, a more robust terrestrial system is needed. Achieving this requires an understanding of the whole system, not only the protected natural areas but also the many influences from the matrix of other land uses around them. The recommended management strategies are three-fold:

1. Secure a targeted system
2. Restore and enhance natural cover
3. Manage the matrix

Strategy 1. Secure a targeted system

The objectives of a target terrestrial natural heritage system are vital to sustainability. A target terrestrial natural heritage system provides a significant opportunity in the "whitebelt" to accomplish the goals of creating a linked natural heritage system, compact transit-supportive liveable communities, and building the necessary infrastructure systems through a balanced and flexible approach to accommodate population growth and city building as required through the Province's *Places to Grow – Growth Plan for the Greater Golden Horseshoe*. The recommended target terrestrial natural heritage system shown in Figure 5–2 identifies lands that should be secured through protective policy, acquisition, easements or stewardship agreements to increase protected natural cover from 32 per cent to 39 per cent of the watershed. This targeted system is about 35,500 hectares. It is expected that the target terrestrial natural heritage system for the watershed will undergo further analysis and refinement at more detailed scales to integrate it with other community planning objectives as part of municipal growth planning exercises, including the "white belt" lands.

Figure 5–2: Target terrestrial natural heritage system



Recommendations

60. Protect lands in a target terrestrial natural heritage system, based on the system shown in Figure 5–2, from development through land use policy, acquisition, easements or stewardship agreements with the following priorities
    1) Potential urban growth areas (i.e. the "whitebelt")
    2) Protected countryside areas of the *Greenbelt and Oak Ridges Moraine Conservation Plans* and the rural area of the *Niagara Escarpment Plan*
    3) Natural core and linkage areas of the *Oak Ridges Moraine Conservation Plan* and natural areas of the *Niagara Escarpment Plan*
    4) Existing urban areas through redevelopment.

    Place additional emphasis on areas where natural cover will achieve multiple watershed benefits, as identified in other sections of this plan (e.g., reduced runoff and erosion, improved aquatic habitat etc.).

61. Toronto and Region Conservation and municipalities should continue to work together to incorporate terrestrial and natural heritage system planning into offical plans. Municipalities should identify a target natural heritage system in their official plans, based on the one recommended in this watershed plan, and adopt policies to protect and restore natural cover within it.

62. Apply the principle of "net gain" that requires compensation for loss of natural habitats and features in the case of private and public sector projects, including infrastructure, such that larger, connected, higher quality habitats are achieved.

Lead responsibility: TRCA, municipalities
Other partners: Province, NGOs, private landowners

Strategy 2. Restore and enhance natural cover

Within each of the priority areas for securement noted above, further priority should be assigned to restoration activities to increase natural cover, especially where this will also achieve other watershed benefits as identified in the strategies for air, water and aquatic systems (e.g., urban tree canopy, riparian areas, important groundwater recharge areas, and subwatersheds where reductions in surface runoff are required to improve water balance and reduce erosive flows).

Maintaining or restoring wetlands on marginal agricultural lands provides both wildlife habitat and hydrologic benefits downstream.
Photography by Lou Wise

The prioritization of restoration activities should also consider the importance of maintaining agricultural land use in the watershed. Natural cover restoration initiatives should avoid productive farmlands (Section 5.5.2). Restoration may be accomplished through natural succession or assisted through planting of native species.

Recommendations

63. Restore areas within the target terrestrial natural heritage system focusing on
    - Areas where natural cover will achieve multiple watershed benefits
    - The most vulnerable habitat patches (e.g., those with species of concern in urban and near urban locations)
    - Existing urban and urbanizing areas
    - Assignment of restoration priorities should consider the importance of maintaining productive agricultural land in the watershed

64. Encourage wetland restoration in agricultural settings, where appropriate.

65. Increase the use and availability of native plant materials.

66. Develop scientific knowledge and restoration techniques that maximize biodiversity. This should include the development of recovery plans for species and communities at risk.

67. Public landowners should continue to set an example of natural heritage protection, stewardship and restoration on their lands.

68. Encourage private landowners to protect, enhance and restore natural cover through incentives, education programs and policy enforcement:
    - Grant programs for improving stewardship, especially for lands in the target system
    - Tax incentives, such as the Managed Forest Tax Incentive Program, Conservation Land Tax Incentive Program and ecological gifts
    - Stronger penalties for non-compliance with municipal tree preservation or natural heritage protection by-laws and policies
    - Increased focus of stewardship programs on raising awareness of rural landowners of the benefits of good stewardship practices and existing incentive programs

Lead responsibility: TRCA, municipalities
Other partners: Federal and provincial governments and agencies, school boards, utilities, NGOs, private landowners

Strategy 3. Manage the matrix

The matrix of agriculture, forestry, transportation, recreation, residential, commercial and industrial land uses has many negative impacts on the quality of natural habitats and the biodiversity they support. There are numerous opportunities to apply good stewardship practices that increase ecological values in the matrix, support ecological functions of adjacent natural areas and reduce harmful impacts on wildlife. Compatible landscape design and practices on adjacent lands can

Good example of a residential development setback from an adjacent natural area with fencing and buffer plantings.

have a significant benefit in reducing negative influences from surrounding land uses through the provision of wildlife habitats and buffers, maintenance of hydrological functions and improved microclimate.

Invasive alien species, such as dog strangling vine, garlic mustard and purple loosestrife, can be addressed through a combination of research, education and stewardship activities.

Recommendations

69. Incorporate community and infrastructure design elements that support natural heritage:
    - New urban areas and infill developments should incorporate design elements, such as buffers and barrier plantings, which improve the interface with existing natural areas.
    - Naturalization should be included in the landscape design of larger public and private properties such as industries, institutions, golf courses, transportation corridors and offered as an option to new home buyers.
    - The use of native plants and environmentally friendly gardening practices should be promoted on smaller properties, commercial areas and streetscapes.
    - Provide designated off-leash pet areas in appropriate open spaces, set apart from sensitive natural areas.

70. Educate pet owners to control the movement of pet cats and dogs to reduce access to wildlife and their habitats.

71. Reduce the occurrence of invasive alien species through
    - Public education and greater involvement of community groups (e.g., scouts and guides) in removal projects
    - Development of educational materials about invasive alien species for horticultural and nursery industries and retail outlets
    - Partnerships among municipal parks departments and other experts to facilitate information sharing about research and effectiveness of control and removal methods
    - Pilot projects to remove or control invasive alien species on public lands

72. Promote stewardship of public and private lands with a variety of existing and new tools, including
    - Coordinated GTA-wide social marketing campaign and incentives program, including backyard certification and awards (see summary of *The Action Plan for Sustainable Practices* in the Stormwater Retrofit Strategy, Section 5.3.5)
    - Increased enforcement of regulations regarding tree cutting, flood plain filling, dumping, recreational activities and encroachment on public land
    - Outreach and education programs for the horticultural industry and gardeners regarding native plant materials and invasive species

Lead responsibility: TRCA, municipalities
Other partners: Federal and Provincial agencies, school boards, utilities, NGOs, landowners

Good example of a heritage building that has been incorporated into a new development in Kleinburg.

5.4 SOCIETY

5.4.1 CULTURAL HERITAGE

Objectives

- Identify, document, protect and conserve cultural and heritage resources
- Celebrate the diverse culture and heritage resources of the Humber Watershed
- Identify and promote the economic value of cultural and heritage resources

Understanding our cultural heritage helps to define our sense of place and provides insights into today's landscapes and environmental conditions. For the purpose of this plan, cultural heritage includes archaeological resources, built heritage resources and cultural heritage landscapes as well as the stories associated with them. It also includes living culture pursuits such as art, performing arts and gardening that are a means of expressing present relationships with our environment.

The review of current conditions in Chapter 3 illustrated the rich human history, recognized in the Canadian Heritage River status of the Humber, as well as the diverse cultures of today's communities. (see Figure 3–11). It also highlighted some key issues that must be addressed in the watershed plan:

- Rich cultural heritage but potential to lose many more heritage sites and landscapes
- Inconsistent and often limited information available about heritage resources
- Lack of suitable repository for archaeological artifacts
- Limited public awareness of both the historical and current relationships between people and the watershed
- Need to adapt cultural heritage programs to meet the needs and interests of the watershed's multicultural communities

Current Initiatives

Amendments to the *Ontario Heritage Act* (April 2005) give the Province and municipalities new powers to stop demolition of heritage sites. They also increase the ability of the Province to identify and designate sites of Provincial heritage significance and to set clear standards and guidelines for preservation. The *Planning Act* and *Provincial Policy Statement*, 2005 allow municipalities to adopt policies and procedures to protect cultural heritage such as demolition control by-laws and requirements for heritage impact assessments and conservation plans. The Ontario Ministry of Culture has published an on-line guide, *Heritage Resources in the Land Use Planning Process*.

The City of Toronto and the City of Vaughan have recently provided an on-line searchable database and interactive map of heritage properties. TRCA and consultants continue to undertake archaeological surveys, update heritage inventories and assess properties for archaeological resources prior to making any site alterations. All municipalities in the Humber watershed except the Township of Adjala-Tosorontio have heritage committees and are working to record, categorize and update their heritage inventories.

Strategies

Six priority strategies have been developed to achieve the cultural heritage objectives:

1) Investigate and conserve cultural heritage prior to changes in land use.
2) Establish a comprehensive communication plan with Aboriginal groups.
3) Fill gaps in archaeological knowledge.
4) Develop active and participatory programs to increase awareness.
5) Develop a living cultural heritage program.
6) Maintain the designation of the Humber watershed as a Canadian Heritage River.

Strategy 1. Investigate and conserve cultural heritage prior to changes in land use

Investigation and conservation of cultural heritage must be undertaken prior to changes in land use, including development, trail creation and reforestation, in accordance with the requirements of the *Ontario Heritage Act*, *Planning Act* and *Environmental Assessment Act*. To help co-ordinate this work, especially in potential future urban growth (whitebelt) areas and redevelopment areas, a proactive master planning approach is recommended.

Recommendations

73. Investigate cultural heritage prior to land use changes to identify opportunities to integrate heritage features, landscapes and stories into new developments:
    - Prepare archaeological master plans identifying lands of high potential significance where detailed investigations should be undertaken prior to development and processes to protect and conserve archaeological resources (the City of Toronto has already done this).
    - Incorporate heritage buildings and their contextual surroundings (e.g., buffers) into proposed developments instead of demolishing them.
    - Develop "quality of place" by identifying and evaluating cultural heritage landscapes and buildings and designating new Heritage Conservation Districts.
    - Develop conservation plans for identified archaeological sites, heritage buildings and cultural heritage landscapes.
    - Protect Aboriginal archaeological sites as green spaces with limited investigative excavations, where possible.
    - Encourage Ontario Heritage Trust to investigate properties with both

Standardizing the identification and protection of archaeological and built heritage

- New Ontario Heritage Act (2005) requirements and Ontario Ministry of Culture Standards and Guidelines (2006) need to be followed as minimum procedures for the investigation and protection of archaeological sites, with participation by First Nations representatives.
- A similar level of identification and protection should be developed for built heritage sites, with the cooperation of Municipal Heritage Committees, to enhance the requirements already in place through municipal official plans.

cultural and natural heritage values for their Natural Spaces Land Acquisition and Stewardship Program.
- Strengthen and expand the municipal documentation process for cultural heritage sites and landscapes to improve effectiveness and consistency.
- Encourage municipal heritage committees to raise awareness among watershed residents of the benefits of identifying and protecting heritage resources, and to exchange information with other committees about their strategies.

Lead responsibility: Municipalities, municipal heritage committees
Other partners: TRCA, Ontario Heritage Trust, First Nations

Strategy 2. Establish a comprehensive communication plan with Aboriginal groups

There is an opportunity to enrich our celebration of heritage through improved relationships with Aboriginal groups. A communications plan that includes a protocol for consultation with recognized Aboriginal groups is recommended as an effective first step in this process. This could set an example for the Ontario Ministry of Culture, conservation authorities and municipalities to use in establishing a process for nation-to-nation two-way, meaningful consultation that archaeologists, First Nations and Metis communities can follow to share information.

Recommendations

74. Develop a communications plan for consultation with Aboriginal groups including:
    - Identify key groups and contacts.
    - Create partnership opportunities for interpretation and awareness programs, viewing of artifacts, program development, education and events.
    - Develop a protocol for consultation with recognized Aboriginal groups.

Lead responsibility: TRCA, Ontario Ministry of Culture
Other partners: Municipalities, First Nations, Metis, other stakeholders

Strategy 3. Fill gaps in archaeological knowledge

Improvements in our archaeological knowledge and improved access to artifacts would increase our understanding of early human cultures and provide a valuable resource to help raise awareness of the cultural heritage of the Humber and enrich contemporary life.

Recommendations

75. Develop a program to fill gaps in our archaeological knowledge and improve our understanding of early human cultures through application of field investigations and local knowledge research:
    - Key gaps include the upper West Humber, upper Main Humber, and upper East Humber along the Oak Ridges Moraine in King Township.

76. Establish a permanent repository for the storage, display and interpretation of archaeological artifacts and documents in collaboration with other local committees and First Nations and Metis representatives:
    - Include secure artifact storage and community-friendly spaces, including places for researchers to work, artifact layout space, and flexible areas for public access.

- Establish box levies on the remover of the artifact for storage (e.g., landowner or project proponent).
- Encourage a trustee approach if ownership of artifacts is an issue (e.g., Aboriginal artifacts).

Lead responsibility: TRCA
Other partners: Municipalities, First Nations, other stakeholders

Strategy 4. Develop active and participatory programs to increase awareness

The most effective means to increase awareness are those that actively engage participants (both adults and youth) in ways that bring heritage to life and incorporate it into daily activities.

Recommendations

77. Develop active and participatory programs (e.g., heritage walks, bus tours, field courses, audio/visual/oral histories) to provide themed learning experiences and increase awareness of local cultural heritage:
    - Pay special attention to the interests of new Canadians.
    - Create learning experiences about Carrying Place Trail heritage.
    - Identify the historic Toronto Carrying Place Trail route and securement of missing links to complete a contemporary trail.
    - Establish public access to a northern gateway to the watershed and the Carrying Place Trail near Hackett Lake, integrating educational programs with Seneca College, and promoting the extension of the Carrying Place Trail northward to the Holland River.
    - Incorporate living culture experiences, such as photography, drawing, painting and performance arts.
    - Develop user-pay approaches to support these programs.

78. Develop community-based projects to incorporate cultural heritage values and themes into the local community fabric:
    - Encourage designation of Heritage Conservation Districts, Cultural Heritage Landscapes and buildings under the *Ontario Heritage Act*.
    - Increase awareness of the historic Carrying Place Trail with interpretive signs on contemporary trails.
    - Produce signs for communities, streets and public buildings with historic names, trail guides and public art.
    - Raise awareness of links between human and natural heritage, for example with interpretive displays about the influences of human activities on historic and current environments.
    - Protect and interpret cultural features that also serve as wildlife habitat (e.g., barn swallows and chimney swifts shelter in active farm buildings, turkey vultures nest in old silos or barns).

79. Develop near urban agriculture, such as community gardens, as an expression of culture in addition to their roles in food production and land stewardship.

80. Request that Ontario Heritage Trust to provide local markers or provincial plaques for areas of heritage significance.

81. Promote culture and heritage resources as part of tourism strategies for local communities.

82. Develop revenue-producing cultural and heritage facilities and programs.

83. Assist schools with program opportunities and materials to implement the Ontario school curriculum on Aboriginal and pioneer life (e.g., at conservation areas and Black Creek Pioneer Village).
    - Explore opportunities for TRCA's archaeological field school to contribute to the new curriculum and develop a sustainable funding plan.

Black Creek Pioneer Village offers opportunities to experience what pioneering life in the mid-ninteenth century was like.
Photography by Rose Hasner

Lead responsibility: School boards, TRCA
Other partners: Municipalities, Ontario Heritage Trust, colleges

Strategy 5. Develop a living cultural heritage program

A living cultural heritage program will enhance interpretive and tourism opportunities in the watershed. It will also help to foster civic pride and sense of community thereby promoting improved stewardship.

Recommendations

84. Develop a living cultural heritage program:
    - Draw upon the databases and inventories of cultural heritage, including built structures and landscapes, and conservation plans for identified sites, buildings and landscapes.
    - Identify heritage assets in need of restoration and looks for opportunities to revitalize heritage properties by forming partnerships to increase revenue and find adaptive re-use, such as interpretive centres, pubs, restaurants, community centres, and art galleries.
    - Promote the use of various media (e.g., photography, drawing, painting, sculpture, performance arts) to increase awareness and appreciation of the watershed.
    - Promote local cultural festivals.

Public art with Humber heritage, nature and river theme.
Photography by Rose Hasner

Lead responsibility: Province, municipalities, TRCA
Other partners: Community Heritage Ontario, Architectural Conservancy of Ontario, Ontario Archaeological Society, other NGOs

Strategy 6. Maintain the designation of the Humber River as a Canadian Heritage River

Recommendations

85. Protect and maintain the human heritage values that were the basis for the designation.

86. Identify and enhance additional human heritage resources.

87. Promote the Canadian Heritage River System and associated values to the public, agencies and businesses in the watershed.

88. Celebrate the rich culture and heritage of the watershed.

Lead responsibility: TRCA
Other partners: MNR, municipalities, heritage organizations

Cultural heritage festivals like the Celtic Music Festival pictured here are opportunities to celebrate and learn about living cultures in the Humber watershed.
Photography by Rose Hasner

5.4.2 NATURE-BASED RECREATION

Objectives

- Incorporate greenspace in all urban and rural developments and create an accessible and connected greenspace system that is compatible with ecological and cultural integrity
- Develop a system of inter-regional trails and local and regional-scale nature-based recreation, education and tourism destinations within the greenspace system

The Humber watershed provides a rich variety of nature-based recreation experiences focused on the kettle lakes, the hills of the headwaters, Humber valley wilderness, urban escape, Black Creek parklands and Humber Bay parklands (Figure 3–11). The Canadian Heritage River designation highlights the importance of natural and cultural heritage in the Humber watershed and these are important themes for recreation activities. It is well documented that active lifestyles promote well-being and health, reducing burdens on the health care system. Through interactions with natural environments, people gain an appreciation for their surroundings and are more likely to support environmental protection and stewardship initiatives. Recreational opportunities also help diversify local economies, and rural areas are increasingly offering resource-based activities such as farm visits, wineries and pick-your-own produce.

In 1996, a survey of Canadians by the Government of Canada revealed that Canadians commit large amounts of their leisure time to activities that depend on natural areas and wildlife. A 2006 survey by Pollara showed that about 54 per cent of watershed residents think it is very important to learn about the environment in an outdoor setting.

However, the population of the GTA continues to grow and is expected to reach six million by 2021. The growing urban population will place increasing pressures on existing greenspaces.

The challenge is to provide a publicly-accessible greenspace system that links natural features, recreation venues and tourism destinations without destroying the integrity of the natural systems.

Some areas in the Humber watershed are particularly deficient in greenspace, specifically the West Humber and East Humber subwatersheds. These areas should receive priority attention for acquisitions.

The review of current conditions in the watershed highlighted the following issues:

- Gaps in trail systems
- Increasing demand for nature-based recreation
- Limited availability of public lands in some areas
- Limited understanding of existing levels of use and carrying capacity of nature-based recreation resources

Current Initiatives

A number of initiatives are underway to protect and increase greenspace in the Humber watershed. For example, the City of Toronto provided $2,000,000 in 2005 and $500,000 in 2006 to TRCA for source water protection, including land acquisition. The regional municipalities of York and Peel have established land acquisition reserves. The Oak Ridges Moraine Foundation has disbursed $15 million for land acquisition, landowner contact and habitat management on the Oak Ridges Moraine, including areas within the Humber watershed. The Conservation Land Tax Incentive Program provides a 100 per cent tax exemption to conservation organizations for eligible portions of a property. TRCA continues to acquire greenspace and is now using the *Terrestrial Natural Heritage Strategy* to establish priorities. The *Ontario Planning Act* requires that developers either convey 5 per cent of new developments to the municipality for parkland and/or other public recreation purposes or provide an equivalent cash value.

TRCA is preparing management plans for conservation areas and other properties. Plans have been completed for Oak Ridges Corridor Park, Palgrave Forest and Wildlife Area, Cold Creek Conservation Area, Boyd North and Glassco Park, and Claireville Conservation Area.

Trail expansion continues in many parts of the watershed. TRCA implemented a five-kilometre multi-use trail in Oak Ridges Corridor Park in 2006 and a 5.5 kilometre multi-use trail in the Granger Greenway in the City of Vaughan. The City of Vaughan has recently prepared a Pedestrian and Bicycle Master Plan. The City of Brampton's Pathways Master Plan received a Canadian Institute of Planners Award in 2003 and The City of Brampton is undertaking a Parks, Culture and Recreation Master Plan and Parkland Acquisition Strategy. The City of Vaughan chapter of the Humber Valley Heritage Trail Association was established in 2005. The Cold Creek Stewardship Committee established 6.5 kilometres of walking trail in 2005 in the Cold Creek Conservation Area (King Township). The

Hiking along nature trails in the Humber River valley is a popular recreational activity but gaps remain in the trail system.
Photography by Rose Hasner

Town of Richmond Hill has recently built 5.5 kilometres of trails in Oak Ridges and established the Walks on the Wild Side Environmental Education Program. In 2003 the Town of Caledon built 0.8 kilometres of hiking trail along the Humber River in Palgrave.

Strategies

Seven priority strategies have been developed for nature-based recreation in the watershed:

1) Recognize and enhance the regional system for nature-based recreation.
2) Complete the inter-regional trail network.
3) Establish public access to a northern gateway to the watershed.
4) Protect the unique experiences of the Humber watershed greenspace system.
5) Develop plans to balance public access and resource protection.
6) Interpret natural and cultural heritage.
7) Form community partnerships for implementation.

Strategy 1. Recognize and enhance the regional system for nature-based recreation

Many partners, including the regional municipalities of Peel and York, local municipalities, the City of Toronto and TRCA, have existing and proposed parks, trails and programs that collectively provide the basis for a nature-based recreation system for regional use as well as neighbourhood access. As noted in the cultural heritage strategies (Section 5.4.1) there is also a role for cultural heritage structures and landscapes to complement the nature-based recreation system through adaptive re-use to serve as interpretive centres or destinations along trails (e.g., restaurants, farmers markets). In order to maximize these opportunities, a multi-partner program should be established with a funding formula, long term funding commitments and operational agreements. This will help to support maintenance and reinvestment in existing properties as well as integrated planning for further expansion and development of the system.

Recommendations:

89. Establish a multi-partner program with long-term funding commitments to support maintenance and reinvestment in existing properties and integrated planning for further expansion of the system and to co-ordinate management, operations and enforcement activities. Priority for additional greenspace should be given to:
    - Gaps in the inter-regional trail system (see also Strategy 3).
    - Areas with limited greenspace, specifically the West Humber and East Humber subwatersheds.

90. Use a range of techniques to increase nature-based recreation opportunities and improve linkages including community planning and design, land acquisition, land trusts, bequests, donations and easements.

91. Provide opportunities for a variety of appropriate uses and experiences at destinations with representative natural and cultural features.

Lead responsibility: TRCA, Regional Municipality of York, the City of Toronto and local municipalities

Other partners: NGOs (including Bruce Trail Association, Humber Valley Heritage Trail Association and Oak Ridges Moraine Trail Association)

Strategy 2. Complete the inter-regional trail network

The Humber watershed includes 213 kilometres of inter-regional trails: Humber Valley Heritage Trail, Bruce Trail, Caledon Trailway, Trans Canada Trail, Great Pine Ridge Trail, Oak Ridges Moraine Trail and Lake Ontario Waterfront Trail. An additional 60 kilometres of inter-regional trails are proposed in the Humber Watershed Trails Plan (Figure 5–3).

Sign indicating the approximate location of the historic Toronto Carrying Place Trail along King Road in King Township

Recommendations

92. Identify and confirm the location of the historic Carrying Place Trail and secure missing links to complete the contemporary trail.

93. Integrate local community trail plans with the inter-regional trail system.

94. Complete community trail plans early in the planning process for greenfield development areas. Funding for implementation should be allocated from development charges.

95. Cooperate with neighbouring jurisdictions to establish greenspace and trail connections to adjacent watersheds.

96. Collaborate with golf course operators, farmers and other private landowners to ensure compatibility of public uses on or adjacent to their properties and secure trail easements.

97. Continue to support the development of pedestrian-only trails in the Humber watershed as a strategic means to foster appreciation of natural areas and the need for conservation.

98. Consult the public on trail alignment and design.

99. Identify funding mechanisms for new trail development and long term maintenance.

100. Design and manage existing and future trails to ensure that
- Trails are accessible, safe, in appropriate locations and environmentally sound
- Trail uses are compatible with natural and cultural heritage features
- Trails accommodate the needs of user groups
- Educational opportunities are provided, highlighting natural and cultural heritage

Lead responsibility: TRCA, Regions of Peel and York, the City of Toronto and local municipalities

Other partners: NGOs (including trail associations and Hike Ontario)

Figure 5–3: Humber watershed trails plan

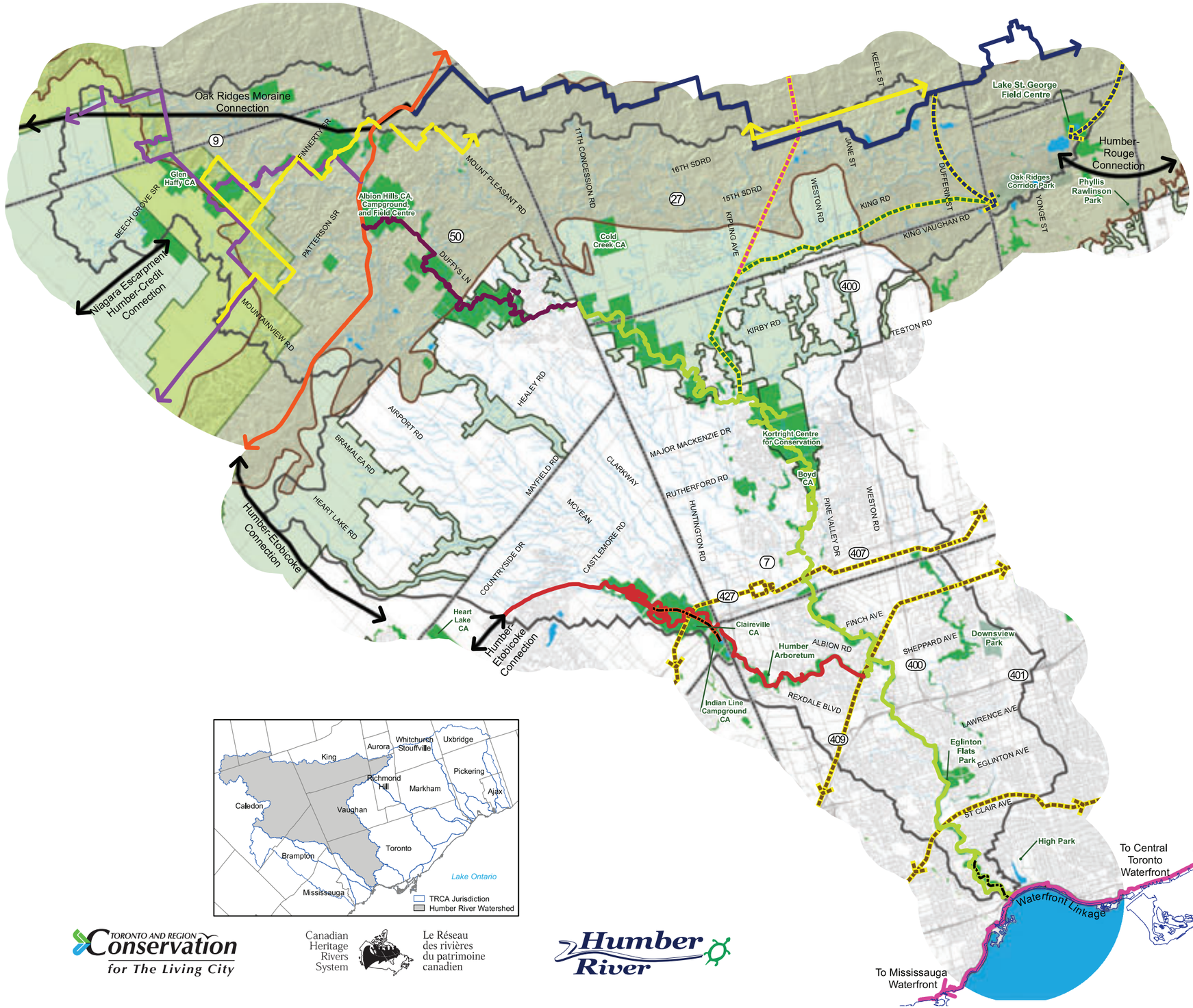
Humber River Watershed Trails Plan

Legend

- Municipal Boundary
- Watercourse*
- Shoreline
- Pond & Lake
- Humber Watershed**
- Oak Ridges Moraine
- Designated Greenspace***
- TRCA Property
- Greenbelt Plan Boundary
- Niagara Escarpment
- Potential Inter-regional Trail Connection
- Bruce Trail
- Humber Trail
- Great Pine Ridge Trail
- Humber Valley Heritage Trail
- Oak Ridges Trail
- Trans Canada Trail
- West Humber Trail
- Waterfront Trail
- Proposed Oak Ridges Trail****
- Proposed East Humber Trail****
- Proposed Hydro Corridor Trail****
- Proposed Carrying Place Trail****
- Claireville Canoe Route
- Humber Bay Canoe Route

0 1 2 4 6 8 10 Kilometres

* Watercourse has been generalized for mapping purposes.
**Watershed boundary delineated from 1:10,000 Ontario Base Mapping. Boundary not approved.
***Major tract of publically owned land designated as future greenspace.
****Routes shown are conceptual locations for trails. Accurate mapping will take place during detailed trail planning and implementation.



TORONTO AND REGION Conservation for The Living City

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Humber River

Strategy 3. Establish public access to a northern gateway to the Humber watershed

Establishment of a northern gateway to the watershed via the Carrying Place Trail near Hackett Lake will help to provide much-needed greenspace in this area, as well as highlight its many interesting natural and cultural heritage features.

The Hackett Lake area.
Photography by Lou Wise

Recommendations:

101. Promote the creation of the Carrying Place Trail from the Granger Greenway near Major Mackenzie Drive to Humber Trails Forest and Wildlife Area and on to the Holland River.

102. Collaborate with landowners to investigate public access opportunities in the Hackett Lake area.

Lead responsibility: The Township of King, the Regional Municipality of York, TRCA
Other partners: Lake Simcoe Region Conservation Authority, heritage groups.

Strategy 4. Protect the unique experiences of the Humber watershed greenspace system

Existing conservation areas, parks and trails in the Humber watershed provide many opportunities for people to experience natural settings and wildlife (Table 3–1). However these experiences are vulnerable to inappropriate uses, conflicts between users and over-use. It is crucial to educate adjacent landowners, recreational users and local decision-makers about natural and cultural resources, watershed functions and the impacts of human activities in order to encourage responsible behaviour and compliance with by-laws and regulations.

Recommendations

103. Educate adjacent landowners, users and local decision-makers about natural and cultural resources, watershed functions and the impacts of human activities on public greenspace.

104. Increase efforts to monitor and address inappropriate uses and impacts of human activities on natural and cultural heritage features and experiences.

105. Provide adequate space for sports fields and other municipal recreation facilities outside valley lands and other nature-based recreation properties.

Lead responsibility: TRCA, Province of Ontario, the regional municipalities of Peel and York, the Township of Adjala-Tosorontio, the Town of Caledon, the Township of King, the City of Vaughan
Other partners: NGOs, residents, stewardship groups, trail groups

Strategy 5. Develop plans to balance public access and resource protection

A guide leading an interpretive nature walk with school children.
Photography by Rose Hasner

Public enjoyment of the natural and rural landscapes of the Humber watershed is an important benefit of a healthy watershed, but it can also affect the resources on which it depends. The lack of data on current uses should be addressed with the help of municipalities, trail groups, anglers and other user groups. Management plans for conservation areas and other greenspaces should be developed to achieve a balance between public access and protection of sensitive ecological and cultural heritage areas. These management plans should be reviewed on a regular basis to reflect changes in environmental, social and economic conditions. Areas that require new management plans include Bolton and Nashville Resource Management Tracts, Albion Hills Conservation Area, Campground and Field Centre, and TRCA's headwater properties including Glen Haffy Conservation Area and connecting properties.

Recommendations

106. Develop plans for public access
    - Create guidelines for compatible use.
    - Create policies and guidelines to phase out or relocate public uses that are incompatible with the objectives of this Watershed Plan or greenspace management plans.
    - Identify unauthorized trails to be decommissioned or establishment of formal trails where appropriate.
    - Create policies and regulations for unauthorized or incompatible uses.
    - Harmonize municipal by-laws regarding appropriate uses of greenspace.
    - Set standards of practice for greenspace managers, such as environmental management systems for public agencies, Audubon Program or equivalent for golf courses, and Environmental Farm Plans for agri-tourism businesses.
    - Monitor program for trail use and participation rates in other activities such as bird-watching, boating, fishing and picnicking to assist in planning and regulating public activities. Involve user groups in collection of this data.

107. Undertake studies to define thresholds for public access in order to protect sensitive ecological or cultural areas
    - Identify types and levels of current use.
    - Estimate future demand trends and levels.
    - Establish criteria for triggering development or review of management plans for public greenspace and trails based on unacceptable impacts on natural or cultural heritage features or visitor experiences.

Lead responsibility: Local municipalities, TRCA, the regional municipalities of Peel and York, and the City of Toronto
Other partners: Stewardship groups and user groups

Strategy 6. Interpret natural and cultural heritage

The maps of Cultural Heritage Highlights (Figure 3–11) and Nature-based Recreation Areas and Experiences (Figure 3–13) provide overall guidance for establishing consistent themes, experiences and interpretive possibilities.

Recommendations

108. Incorporate information about the Oak Ridges Moraine and Niagara Escarpment on trail head signs and interpretive signs in parks and along trails (e.g., Discovery Walks in the City of Toronto, Walks on the Wild Side in Town of Richmond Hill).

109. Provide interpretive opportunities regarding the importance of natural resources to the historical development of local economies (e.g., mill sites).

110. Ensure that the interpretation of natural and cultural heritage is included in park management plans prepared by TRCA and local municipalities.

111. Establish conservation and agri-tourism themed partnerships.

Lead responsibility: TRCA, the regional municipalities of Peel and York, the City of Toronto and local municipalities
Other partners: NGOs

Strategy 7. Form community partnerships for implementation

Partnerships should be formed with the community across the watershed to participate in activities to improve nature-based recreation opportunities.

Recommendations

112. Continue existing and establish new community partnerships to assist with raising public awareness, developing trail guides and other interpretive materials, delivery of interpretive programs (e.g., local experts leading themed hikes), special events, fundraising, recruiting volunteers for restoration projects and ecological monitoring.

113. Create appropriate economic spin-offs by promoting opportunities for private and public sector involvement on publicly owned lands.

Lead responsibility: TRCA, the regional municipalities of Peel and York, the City of Toronto and local municipalities
Other partners: NGOs, user groups (e.g., trails, fishing, heritage etc), representatives of First Nations groups, stewardship groups, and residents and ratepayers associations.

5.5 ECONOMY

Objectives

- Protect the form and function of landforms such as the Niagara Escarpment, Oak Ridges Moraine and South Slope
- Balance economic development with protection of the environment and society
- Improve sustainability in urban form at community and building site scales

5.5.1 URBAN LAND USE

The review of current conditions in the Humber watershed showed that despite efforts to mitigate the negative impacts of development, degradation is still occurring in many aspects of the watershed ecosystem.

The key land use issues are:

- Losing natural cover and inconsistent application of buffers between developments and natural features.
- Losing of headwater streams.
- Encroaching on valley landforms and public lands.
- Intensifying flood prone urban areas.
- Older systems of stormwater management that result in water pollution and extreme flows
- Changing water balance due to increase in impervious surfaces with urbanization.
- Stripping of topsoil, erosion and sediment from construction.
- Environmental impacts associated with poorly-designed watercourse crossings
- Impacts of subsurface infrastructure on groundwater
- Development patterns and population densities that do not support transit
- Traffic congestion and vehicle emissions

Current Initiatives

Over the past decade, a number of initiatives have been developed that guide urban growth and improve environmental protection. They include the *Niagara Escarpment Plan*, *Oak Ridges Conservation Plan*, the *Greenbelt*, the revised *Provincial Policy Statement*, the *Growth Plan for the Greater Golden Horseshoe*, the *Clean Water Act* and *Ontario Regulation 166/06*. The regions and many of the municipalities have sustainability initiatives, including the *York Region Sustainability Strategy: Towards a Sustainable Region*, the Liveable Peel Initiative, and the *City of Toronto Strategic Plan*.

Within this broad framework, many new approaches to living more sustainably are now being implemented and demonstrate how communities can be designed and managed to enhance quality of life, provide economic opportunities and protect ecological integrity. These approaches are being implemented worldwide. They include new urbanism, eco-towns, transit-oriented compact communities, co-housing, low impact development and green building design. In the Humber watershed, "Block 39" in the City of Vaughan (Rutherford Road and Pine Valley Drive) is being developed to Energy Star standards by eight developers working with TRCA, the City of Vaughan, Power Stream, and Canada Mortgage and Housing Corporation. Similarly, the recently approved Noble Ridge community in the Village of Nobleton will offer energy and water saving features (e.g., solar power, heat pumps, cisterns for rain collection and irrigation) at cost.

The Earth Rangers building at the Living City Campus at Kortright is a certified green building.
Photography by Rose Hasner

Toronto and Region Conservation's Living City programs gather information, establish local partnerships and develop networks with world leaders in sustainable community design. Example activities include the Sustainable House Archetype Design Competition and Demonstration Building that will be constructed at the Living City Campus at Kortright in 2008. The Earth Rangers Building at the Living City Campus has LEED Gold status and the new TRCA Restoration Services Building at Boyd Conservation Area has achieved a LEED Platinum rating. TRCA also participates on a national committee of the Canada Green Building Council to develop certification standards for LEED for Neighbourhoods.

The City of Toronto has introduced *Green Development Standards* with performance targets and guidelines for site and building design that integrate components from green building certification systems such as LEED and Green Globes with existing city development standards.

What is LEED?

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is a benchmark for the design, construction, and operation of high performance green buildings. It encompasses sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. LEED for Neighbourhood Development (LEED-ND) includes compact design, proximity to transit, mixed use, mixed housing type, and pedestrian- and bicycle-friendly design.

What is Energy Star?

Natural Resources Canada provides standards for residential energy efficiency that are 40 per cent more efficient than current Ontario Building Code Standards.

Strategies

Five complementary strategies are recommended to guide future development as well as redevelopment of existing urban areas and their infrastructure:

1) Protect significant landforms.
2) Implement sustainable urban form.
3) Address risks associated with urban intensification in flood prone areas.
4) Implement sustainable infrastructure.
5) Implement sustainable transportation.

Strategy 1. Protect significant landforms

The significant landforms of the Humber watershed—the Niagara Escarpment, Oak Ridges Moraine and the valley and stream corridors—perform vital ecological functions and help create a distinct sense of place. As noted above, a number of policies, plans and regulations are available to help protect these landforms.

Recommendations

114. Apply policies, plans and regulations that provide for landform protection including the *Niagara Escarpment Plan*, *Oak Ridges Conservation Plan*, *Greenbelt Plan*, 2005 *Provincial Policy Statement*, *Growth Plan for the Greater Golden Horseshoe*, *Clean Water Act*, TRCA's Generic Regulation and municipal official plans.

115. Encourage landform protection through municipal by-laws, conservation easements and private land stewardship where public ownership is not feasible.

Lead responsibility: Municipalities
Partners: TRCA, NGOs

Strategy 2. Implement sustainable urban form

Built and natural systems are interdependent; how a community is planned and built affects the function of the natural system. The more robust the natural system, the more resilient it will be to negative impacts from human activities. Community design also affects the ease, convenience and efficiency with which its residents can practice sustainable behaviours.

Sustainability principles must be applied to new development in greenfield areas, intensification projects and in the rehabilitation or redevelopment of existing urban communities. More specific details are provided in the report on *Development of a Sustainable Community Scenario for the Rouge River Watershed* and the *Humber River Watershed Scenario Modelling and Analysis Report*. We recognize that many of the new designs and technologies for sustainable urban development are still evolving and being tested, Therefore, we recommend that development should proceed with caution. An adaptive management approach should be applied based on monitoring results as well as extensive public consultation to assess how well watershed objectives and targets are being met and recommend adjustments to development practices when necessary.

Recommendations

Humberwood Community Centre in Toronto features many green building attributes including naturalized landscaping, stormwater bioretention areas and porous paving.
Photography by Dean Young

116. Apply sustainability principles and measures to urban form at all scales—watershed, community and building site—as detailed in *Development of a Sustainable Community Scenario for the Rouge River Watershed* and the *Humber River Watershed Scenario Modelling and Analysis Report*.

117. At the watershed scale
- Municipalities should identify a target natural heritage system in their official plans, based on the one recommended in this Watershed Plan (Figure 5–2) and adopt policies to protect and restore natural cover within it.
- Continue protection for natural heritage and agricultural lands afforded by the *Provincial Policy Statement*, *Greenbelt Act*, *Oak Ridges Moraine Act*, TRCA's *Valley and Stream Corridor Program* and municipal official plans.

118. At the community scale, implement innovative design to achieve pedestrian-oriented, transit-supportive, ecologically sustainable, mixed-use communities:
- Protect and enhance natural systems (see Water, Aquatic System and Terrestrial System strategies).
- Protect and emphasize cultural heritage (see Cultural Heritage strategies).
- Secure public sector lands for infiltration and stormwater management to complement lot level practices (e.g., along road rights of way, along trails, in parks, on municipal properties).
- Re-use of stormwater (e.g., for irrigation of landscapes, see also Water strategies).
- Use renewable energy sources and district energy schemes.
- Increase building density on smaller lot sizes.
- Minimize impervious surfaces including reduced street widths in low traffic areas, innovative road network designs and shared or underground parking.
- Reduce travel needs through mixed-use development.
- Create sustainable transportation (e.g., transit, cycling and walking).
- Build pedestrian scale streetscapes that promote walking and social interaction.
- Retrofit existing urban areas and design new ones to increase ecological values and reduce resource use.
- Achieve green building certifications (e.g., LEED for Neighbourhoods or Green Globes).
- Make provisions for near urban agriculture and community gardens.

119. At the scale of the individual building site, minimize resource use, maintain pre-development water budget and improve environmental quality with
- Lot level and conveyance stormwater management (see water strategies)
- Policies to ensure that all new public and commercial buildings are designed to achieve green building certification and that all existing buildings are retrofitted to improve performance (e.g., public buildings should achieve LEED Gold or higher)
- Incentives for builders to promote green building design
- Building orientation to maximize sunlight, passive solar energy, wind shelter and natural ventilation

- Landscaping to reduce energy needs, water use and urban heat island effect
- Dual plumbing to use recycled water for toilet flushing or irrigation
- Building design for multiple uses and diverse densities to increase life span and maximize land use efficiency

120. Implementation of sustainable urban form should also include
    - Strategies to ensure review and approval processes accommodate non-traditional innovative design components, including training for development proposal review staff.
    - Municipal guidelines (such as Toronto's Green Development Standard)
    - Incentives for more sustainable designs (such as Toronto's Green Roof Program)
    - Increased awareness among developers and builders of new approaches and successful experiences from other jurisdictions
    - Increased awareness and information for homebuyers to help them make sustainable purchasing decisions
    - Encouragement for residents to make sustainable choices in all aspects of their lifestyles
    - Recognition, celebration and promotion of sustainable practices through awards for residents, businesses, agencies and institutions

Lead responsibility: Municipalities
Other partners: Province, TRCA, Greater Toronto Home Builders Association-Urban Development Institute, individual developers, NGOs

Strategy 3. Implement sustainable infrastructure

Urban infrastructure includes pipelines, railways, roads and highways, sewers, water supplies, treatment plants and reservoirs and involves a broad range of associated challenges to ecosystem functions and natural landscapes. As advocated in the Regional Municipality of York's 2006 strategy *Towards a Sustainable York Region*, environmental and servicing objectives should be considered in advance of the community planning process. This will help to avoid or minimize negative impacts to natural systems and achieve net gain wherever possible through innovative design. It may require more detailed work initially to establish baseline environmental conditions, so that more informed choices can be made between alternatives.

Recommendations

Major infrastructure corridor crossing the Humber River valley. Photography by Lou Wise

121. Establish baseline environmental conditions early in the planning stages and make informed choices among alternatives to avoid or minimize impacts to natural systems and achieve net gain wherever possible through innovative design. Specifically, it is recommended that
    - An Environmental Assessment (EA) should be undertaken for the complete project to facilitate evaluation of the possible overall and cumulative impacts.
    - Construction of any underground service should strive to minimize or avoid dewatering and transfer of water across watersheds.
    - Carrying capacity, need (sizing) and alternatives to the undertaking and construction options should be fully assessed.

- All options for different horizontal and vertical alignments for new subsurface infrastructure should be considered for their cumulative impact(s) on aquifers.
- The decision making process should balance the needs of all stakeholders and adhere to the principle of the "Quadruple Bottom Line".
- Any changes in design or construction technique should require further public and agency consultation and an addendum to the EA.
- Construction should be monitored to ensure compliance and adjustments made if any negative impacts exceed predictions.
- After construction is completed, the proponent should verify that environmental conditions have been restored, or improved, to those that existed before construction started.
- A performance bond of sufficient magnitude should be held by the MOE or TRCA or other appropriate public body to ensure that conditions are restored or improved as specified in the EA.

122. In developments where the water table is shallow, convey cool, clean groundwater collected by foundation drains directly to watercourses or wetlands rather than stormwater ponds, where possible, to avoid contamination and increases in temperature.

123. Encourage opportunities to remove or decommission existing infrastructure in natural areas when redevelopment occurs.

Lead responsibility: Province, municipalities
Other partners: TRCA

Strategy 5. Implement sustainable transportation

The cities of Toronto, Brampton and Mississauga and the regional municipalities of Peel and York have prepared plans that identify new and improved transportation infrastructure needed to serve existing communities and future growth. Recognizing the linkages among transportation modes, energy use, air quality and climate change, these plans include strategies to develop and encourage the use of transit systems and alternatives to private automobiles (e.g., walking and cycling) and to make the best use of existing infrastructure.

Recommendations

124. Vigorous implementation of existing regional and municipal transportation strategies, particularly the transit, high occupancy vehicle, cycling and pedestrian components
    - strategic transportation corridor and network planning studies and systems planning before environmental assessments are undertaken for specific projects
    - comprehensive transportation planning and coordination among jurisdictions
    - planning for transportation early in the growth planning process so that all opportunities can be taken to reduce the number of crossings of stream and other natural heritage corridors
    - application of the recommendations listed above under "sustainable infrastructure" for the planning of transportation infrastructure

Lead responsibility: Municipalities, TRCA
Other partners: GO Transit, Ministry of Transportation

Farmlands contribute to the health of the watershed by acting as carbon sinks, helping to reduce greenhouse gases, are more conducive to the protection of natural systems than most other land uses and are part of the watershed's cultural heritage. Photography by Dean Young

5.5.2 AGRICULTURE

Objective

- Protect and enhance the integrity and economic viability of agricultural areas

Agricultural lands comprise about 40 per cent of the Humber watershed. They make an important contribution to Ontario's economy and help to reduce our ecological footprint by supplying locally grown food and decreasing our reliance on unsustainable imports. In addition, they contribute to the health of the watershed in a variety of ways. Farm crops act as carbon sinks, helping to reduce greenhouse gases. Farmlands are more conducive to the protection of natural systems (e.g., water balance, natural cover and wildlife habitats) than most other land uses. Countryside landscapes are also part of the watershed's cultural heritage and provide a context for many recreation activities and rural lifestyles.

Unfortunately, as described in the review of current conditions in Chapter 3, the ability of agricultural lands to provide these benefits is constrained by some critical issues:

- Declining availability of large contiguous parcels of prime land for traditional forms of agriculture
- Poor economic viability of traditional agricultural industry
- Conflicts between farming and adjacent land uses
- Slow uptake of non-traditional crops and agricultural systems

Current Initiatives

In February 2005, the GTA Agricultural Working Group, composed of staff and stakeholders from the regions of Durham, Halton, Peel, York and the City of Toronto, published the *GTA Agricultural Action Plan* to address the long-term sustainability of agriculture in the GTA. The plan includes 37 recommendations regarding economic development, education, marketing,

land use policy, accountability and responsibility. The Humber Watershed Alliance shares the overall goal of this plan and endorses its recommendations.

Different approaches including growing specialty crops for niche markets, community-supported agriculture and urban community gardens are being developed by NGOs such as Everdale Organic Farm and Learning Centre, FoodShare, The Stop Community Food Centre, Local Flavour Plus and Black Creek Urban Farm.

Strategies

The main thrust of the strategies to improve agricultural vitality is to support implementation of the *GTA Agricultural Action Plan*. The best opportunities to do this are associated with the following actions:

1) Provide GTA-wide services for local farm businesses
2) Support local food and increase public awareness about sustainable agriculture
3) Implement policies to support agriculture

Strategy 1. Provide GTA-wide services for local farm businesses

Among the recommendations in the *GTA Agricultural Action Plan*, the following initiatives are especially relevant to stakeholders in the Humber watershed. Local leaders should co-ordinate with the GTA Agricultural Action Plan Implementation Committee to advance them.

Recommendations

125. Promote best management practices, awareness of resource materials and financial grant opportunities.

126. Assist farmers to address requirements for nutrient management, source water protection, environmental farm plans, and natural heritage stewardship.

127. Facilitate complementary activities based on agriculture, such as farm vacations, bed and breakfast stays, tours, recreation/entertainment ventures, farm markets, etc.

128. Partner with food growers to use public lands to research and encourage new crops and farming methods.

129. Provide training and skills development for new forms of urban agriculture.

Lead responsibility: GTA Agricultural Action Plan Implementation Committee
Other partners: Municipalities, regional Federations of Agriculture, Province, NGOs

Strategy 2. Support local food and increase public awareness about sustainable agriculture

The United Nations Urban Environmental Accord sets a target that 20 per cent of our food should be supplied from local, rather than imported, sources by 2012. Community supported agriculture, whereby participants pre-purchase weekly produce from local farms, is an emerging trend in urban areas, particularly with organic growers. Watershed stakeholders, particularly institutions and businesses with significant buying power (such as schools, colleges, universities, hospitals, hotels and restaurants) should participate in such programs. This will bring more predictability to farm incomes as well as fresh, local food to city residents.

Community garden, Downsview

Community gardens should also be encouraged because they can provide valuable opportunities for urban residents to work together in shared private or public spaces to grow vegetables, fruits and flowers for their own use.

Recommendations

130. Develop and participate in "local food first" programs.

131. Grow products for local niche markets (e.g., new Canadians, gourmet restaurants).

132. Adopt a locally-grown food procurement policy.

133. Educate the public and food industry about
    - Values of maintaining viable farms in the watershed
    - Importance of respecting the business needs of agricultural enterprises
    - Links between local foods and their contribution to health
    - Education, awareness and marketing materials available in the languages spoken in Toronto Region watersheds.

134. Support existing community gardens and seek opportunities for new ones on public or shared private lands, especially in proximity to high density residential areas where residents do not have access to private gardens.

Lead responsibility: GTA Agricultural Action Plan Implementation Committee
Other partners: Municipalities, regional federations of agriculture, and institutions and businesses with significant buying power (e.g., schools, colleges, universities, hospitals, hotels and restaurants)

Strategy 3. Implement policies to support agriculture

It is important to continue the protection of agricultural lands through provincial legislation (e.g., *Provincial Policy Statement*) and municipal official plans. A variety of complementary measures are recommended to better protect these lands in the future.

Recommendations

135. Encourage compact urban development, infill and re-development.

136. Maintain firm urban/rural boundaries.

137. Improve transit and travel demand management.

138. Restore productive agricultural lands and natural cover during the rehabilitation of former aggregate pits where possible.

139. Develop a financial compensation mechanism for the ecological services provided by good farm stewardship practices.

140. Include community gardens in new communities.

Lead responsibility: Province, municipalities
Other partners: Aggregate industry

5.5.3 RESOURCE USE

Chapter 3 showed that resource uses in the Humber watershed are similar to other communities in the GTA. We are using water, energy and materials, and generating wastewater and solid wastes at unsustainable rates as well as releasing pollutants to the environment. Some of the key issues are:

Objectives

- Practice sustainable resource use by individuals, households, businesses, institutions and governments
- Use ground and surface water at sustainable rates

- High water consumption rates
- Need to protect sources of drinking water from potential sources of contamination or reductions in availability
- Economic costs, air pollution and greenhouse gas emissions associated with transport of solid waste out of the Region

Current Initiatives

As noted in Chapter 3, all levels of government are engaged in initiatives to reduce resource use and the associated negative impacts. These initiatives provide a foundation for increasing awareness and encouraging actions towards sustainability.

For example, the GTA Mayors' Megawatt Challenge has provided a friendly competition to encourage municipalities to reduce energy use in their facilities. Participating municipalities include the City of Toronto, The City of Brampton, the City of Mississauga, the City of Vaughan

and Town of Richmond Hill. Municipal water efficiency and waste reduction strategies have been extremely successful at engaging homeowner participation. TRCA's Sustainable House Demonstration, to be constructed at the Living City Campus at Kortright in 2008, will provide the public with examples of how they can reduce their resource use in the home. The Regional Municipality of York is developing a single-stream, integrated material recovery facility which will increase efficiency of their recycling and reuse programs.

Strategies

The recommended strategies for resource use address water, energy and waste:

1) Increase water efficiency and conservation
2) Reduce energy use and increase non-fossil fuel alternatives
3) Reduce waste

Strategy 1. Increase water efficiency and conservation

Water conservation contributes to the protection of aquatic ecosystems, protection of drinking water sources and cost effectiveness of public services. It postpones the need for water supply infrastructure expansion, allowing new growth or intensification to be accommodated with the present supply. Conservation also reduces the energy costs associated with pumping water from Lake Ontario up to the headwater service areas and the associated energy and other costs of wastewater treatment.

As described in Section 3.4.4, the Regional Municipality of York, the Regional Municipality of Peel and the City of Toronto have well established and successful water efficiency programs that have set targets for water conservation as part of their long term water supply strategies. These programs involve comprehensive public education and awareness initiatives, including incentives for implementing water conservation practices.

Rain water harvesting with a rain barrel (pictured here) or cistern helps to conserve water and achieve stormwater management objectives.
Photography by Rose Hasner

Recommendations

141. Continue implementation of Water Smart Peel, the Regional Municipality of York's Water for Tomorrow Programs and the City of Toronto's Water Efficiency Program:
    - Use strategies and recommendations in this Watershed Plan as a guide in future updates of the water supply master plans and water efficiency programs.
    - Consider the role of rain-harvesting as a water conservation measure.
    - Monitor indoor and outdoor water use over time.
    - Monitor rates of water use by local service area and evaluate trends over time.
    - Consider water pricing in combination with stormwater management fees as tools to provide incentives for more efficient water use (e.g., use of rainwater on site as a resource to offset potable water needs).

Naturalized landscaping with native plants that are drought tolerant helps to conserve water and attract wildlife.
Photography by Dean Young

- Incorporate relevant findings and recommendations from the *Action Plan for Sustainable Practices* (Freeman Associates, 2006) to improve rates of participation in water efficient practices by residents and businesses.
- Raise awareness of water conservation practices and technologies through partnerships with schools and community groups (e.g., ultra low flush toilets, low flow shower heads, rain sensor switches for automated irrigation systems).
- Improve public confidence in the public water supply to reduce demand for bottled water.
- Naturalize lawns and parks with use of native species that are more drought tolerant.

142. Use baseline baseflows defined by TRCA to determine the threshold below which no surface water may be drawn from a watercourse unless detailed studies are undertaken to support other withdrawal volumes:
    - Water users should install fixed intakes to prevent withdrawals below the baseflow threshold.
    - Irrigation water supply systems should be retrofitted to replace stream sources with rainwater from surface water storage reservoirs, where possible.

143. Ensure that all required water users have a valid permit to take water and monitor their withdrawals, and that applications for permit renewals are reviewed regularly for consistency with the directions of this Watershed Plan.

Lead responsibility: Regional Municipality of Peel, Regional Municipality of York, City of Toronto, MOE, TRCA

Other partners: Local municipalities, MMAH, Greater Toronto Home Builders Association-Urban Development Institute, NGOs

Strategy 2. Reduce energy use and increase non-fossil fuel alternatives

Overall energy use should be reduced and the use of non-fossil fuel and green power sources should be increased.

Recommendations

144. Promote partnerships between utilities and municipalities to facilitate the use of district energy schemes and renewable energy sources as part of the community design.

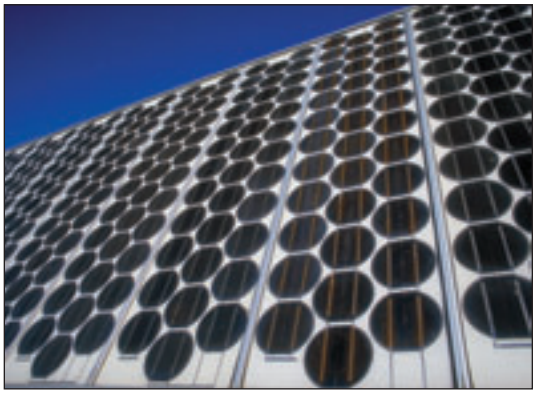
145. Encourage public transit use, walking, cycling and other alternatives to the private vehicle.

146. Provide incentives for use of hybrid or non-fossil fuel powered vehicles.

147. Continue the GTA Mayors' Megawatt Challenge.

148. Provide incentives for building retrofits to improve energy efficiency by 30 per cent or more energy efficient than the model National Energy Code for Buildings.

149. Require new homes to meet standards such as EnergyStar Certification or an EnerGuide rating greater than 80.



The Living City Campus at Kortright is home to the largest alternative energy demonstration in Canada.

150. Increase application of energy conservation practices (e.g., visual monitoring systems that allow users to see energy use; discontinue bulk metering, photosensor and motion sensor controls; lower speed limits for commercial vehicles and transit).

151. Promote in-house, grid-tied energy generation capacity using renewable energy sources, with surplus energy purchased by the utility at the market rate.

Lead responsibility: Municipalities, utilities, Greater Toronto Home Builders Association-Urban Development Institute

Other partners: TRCA

Strategy 3. Reduce waste

The amount of waste generated should be reduced and, wherever possible, "waste" should be used as a resource.

Recommendations

152. Reduce packaging.

153. Foster partnerships between waste generators and waste re-users.

154. Re-use or recycle construction and demolition waste to meet or exceed the Canadian Green Building Council's target for 20% or less construction waste to landfills (currently 35 per cent goes to landfills).

155. Establish programs to test the performance of products made with re-used materials.

156. Incorporate recycling areas throughout buildings with a central collection area to make source-separation convenient.

157. Standardize minimum requirements for recycled aggregate material.

Lead responsibility: Municipalities, Greater Toronto Home Builders Association-Urban Development Institute
Other partners: Businesses, residents

CHAPTER

6

6.0 IMPLEMENTATION

The preceding sections described management strategies and actions recommended to achieve the objectives and targets of this watershed plan. Implementation of the watershed plan will rely on the adoption of supportive policies, programs and practices by the various partners. Specifically, the watershed plan is intended to inform and guide municipalities, provincial and federal governments, and the Toronto and Region Conservation (TRCA) as they update their policies and programs for environmental protection, conservation and restoration within the contexts of land and water use, and the planning of future development. The plan also provides direction to local non-governmental organizations and private landowners with regard to best management practices and opportunities for environmental stewardship. Implementation of the recommendations in this watershed plan will be most effective if watershed partners co-ordinate their efforts and make creative use of existing and new tools as outlined below:

1) Policy
2) Regeneration
3) Land securement
4) Stewardship and education
5) Operations and maintenance
6) Enforcement
7) Monitoring

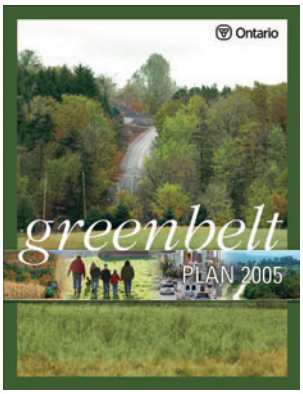
The Humber Watershed Alliance will continue to play an important role in promoting good stewardship of the watershed and participating in actions to implement the watershed plan. Membership in the Alliance includes unaffiliated watershed residents, representatives from interest groups, school boards and business associations, politicians from local and regional municipalities, agency staff and the Chair of TRCA. This broad membership connects the Alliance to many other watershed partners, helping to disseminate information and encourage action by governments, businesses and communities. Community Action Sites have been identified where regeneration actions will be undertaken in partnership with the local community. The Alliance also publishes report cards and progress reports to help evaluate successes and highlight priorities for further work. The Alliance worked to have the Humber designated as a Canadian Heritage River and publishes a newsletter—the *Humber Advocate*—to spread the word about the importance of the watershed and the activities supporting it.

6.1 POLICY

Existing policies and programs

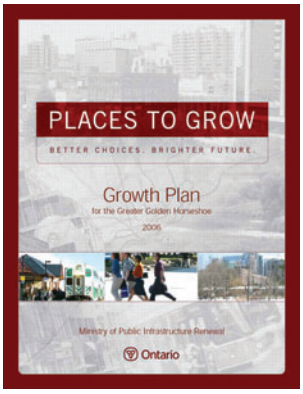
Many stakeholders, including federal and provincial governments, municipalities, TRCA, NGOs, businesses and individual citizens, will be able to play a role in implementing this watershed plan. Many of these partners already have policies and programs in place and the capacity to implement aspects of the plan. It is recommended that all partners use the information and recommendations of the watershed plan to inform their ongoing programs and decision-making. Where necessary, partners should consider updating or amending their policies or programs based on direction provided in this plan. The ten year workplan of recommended initiatives outlined in the *Humber River Watershed Plan Implementation Guide* provides more specific guidance in this regard.

Provincial initiatives



Recent provincial initiatives—the *Greenbelt Plan*, the *Growth Plan for the Greater Golden Horseshoe*, the *Oak Ridges Moraine Conservation Plan* and the Source Water Protection programs—provide a broad context for the protection and sustainable use of natural resources and a framework for development and investment. This watershed plan provides more specific guidance for their implementation.

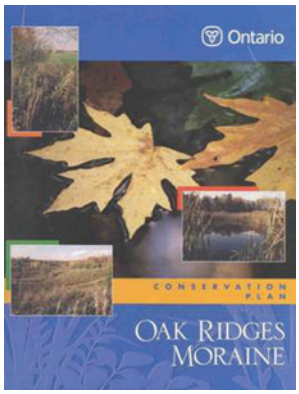
Greenbelt Plan



Section 3.2.3 of the *Greenbelt Plan* (2005) states that watersheds are the most meaningful scale for hydrological planning and municipalities, together with conservation authorities, should ensure that watershed plans are completed and used to guide planning and development decisions within the Protected Countryside. Therefore, the Province and municipalities should implement the recommendations of the *Humber River Watershed Plan* in planning and development decisions within the Protected Countryside of the *Greenbelt Plan*.

Growth Plan for the Greater Golden Horseshoe

The *Growth Plan for the Greater Golden Horseshoe* (2006) covers those areas outside the Protected Countryside noted above, and requires municipalities to amend their official plans to comply. Therefore, we request the Ministry of Public Infrastructure and Renewal and other relevant agencies to address the *Humber River Watershed Plan* recommendations through Implementation Analysis and Sub-Area Assessment (s.5.3/p. 35 of the *Growth Plan*).



Oak Ridges Moraine Conservation Plan

Section 24 of the *Oak Ridges Moraine Conservation Plan* (ORMCP) requires every upper-tier municipality and single-tier municipality to begin preparing a watershed plan, for every watershed whose streams originate within the municipality's area of jurisdiction. The objectives

and requirements of each watershed plan are to be incorporated into the municipality's official plan. Major development within the ORMCP area commenced after April 23, 2007 is prohibited unless it conforms to the watershed plan. The watershed plan objectives and requirements will be interpreted and implemented in the process of developing municipal official plan policies. The *Humber River Watershed Plan* provides an understanding of the overall health of the watershed and sets out strategies to maintain and improve its ecological and hydrological integrity. These strategies will help guide the development of official plan policy so that the ORMCP conformity requirements for major development are clearly linked to municipal official plans and the land use planning process.

Source Water Protection Planning

The *Clean Water Act* sets direction for the preparation of source water protection plans within each source water protection planning region in Ontario. Toronto and Region Conservation is the lead conservation authority for the Credit Valley—Toronto—Central Lake Ontario (CTC) Region. We therefore request that the CTC Source Protection Committee be advised of the *Humber River Watershed Plan* and its recommendations.

Policy recommendations of the *Humber River Watershed Plan* are listed in the *Humber River Watershed Plan Implementation Guide* under two themes:

- **New policy directions**—These directions build on the recommendations of this watershed plan and model policies from the YPDT/CAMC guidance document, *Watershed Planning—From Recommendations to Municipal Policies* (Anthony Usher and Ogilvie, Ogilvie and Company, 2005). They are intended to provide approaches that municipal planners can use as the basis for crafting policies tailored to local circumstances and specific formats of municipal official plans. It is recognized that existing municipal official plans already contain many good environmental policies. The policy recommendations in the implementation guide are meant to strengthen these existing policies or provide policy direction for new and emerging topic areas. They will be particularly useful to inform further official plan policy discussions as they relate to growth planning issues.

- **Special policy-related initiatives**—The recommended special policy-related initiatives or studies are often associated with the new policy directions. They are to be implemented through provincial legislation and plans for the Oak Ridges Moraine, Greenbelt, Growth Management, Source Water Protection, municipal by-laws and special studies.

6.2 REGENERATION

Many of the recommendations can be achieved through regeneration initiatives on public or private lands. Regeneration is defined in this watershed plan as "in the ground" works, on either publicly owned or large tracts of privately owned land that address the following objectives:

- Water quality and quantity management (e.g., SWM retrofit projects)
- Aquatic and terrestrial habitat enhancement (e.g., tree planting, wetland creation, fish barrier mitigation)
- Flood and erosion risk remediation (e.g., culvert enlargements, infrastructure protection)
- Trail development and infrastructure support for nature-based recreation
- Infrastructure support for achieving cultural heritage objectives

Top priority regeneration projects include:

- Preparation of natural heritage restoration plans for target terrestrial natural heritage system lands in the "whitebelt" and priority areas in the headwaters
- A co-ordinated program to accelerate the implementation of improvements to stormwater management in existing urban areas in conjunction with social marketing campaigns
- Habitat restoration in the Humber Marshes
- Further modification of in-stream barriers in the Lower Humber
- Establishing a facility for archaeological artifact and document storage and access
- Projects to increase awareness of the Carrying Place Trail heritage of the Humber

The *Humber River Watershed Plan Implementation Guide* includes subwatershed regeneration plans that identify high priority regeneration actions associated with three integral management directions:

- **Expand the terrestrial natural heritage system** by creating and enhancing natural cover in the target terrestrial natural heritage system and riparian areas. Secure the 1.2 per cent (approximately 446 hectares) of the targeted system that is not yet protected by policy mechanisms and achieve an increase in natural cover of 500 hectares or 1.7 per cent over 2002 levels by 2012.
- **Build sustainable communities** by improving stormwater management, naturalizing landscapes and undertaking other projects to increase the urban tree canopy.
- **Recognize and enhance the regional open space system** to provide nature-based recreation and cultural heritage experiences by extending the inter-regional trail network and creating links to local trails, securing additional lands for greenspace and minimizing the impacts of public use on natural habitats and wildlife.

While the strategies and actions outlined above should be applied throughout the Humber watershed, the five primary subwatersheds (Figure 3–7) have distinct characteristics and face different levels of stress. As a result, they have different regeneration priorities, as summarized below.

6.2.1 MAIN HUMBER SUBWATERSHED

Much of the Main Humber subwatershed is subject to the protective policies of the Niagara Escarpment, Oak Ridges Moraine and Greenbelt legislation. Some lands designated as settlement areas in the *Oak Ridges Moraine Conservation Plan* coincide with important groundwater recharge areas, therefore low impact development designs and stormwater management measures that infiltrate clean runoff are recommended.

Parts of the Main Humber subwatershed are in the "whitebelt" (lands that are not included in current official plans and are not protected by the Niagara Escarpment, Oak Ridges Moraine and Greenbelt legislation). Within these areas, lands that are identified in the target terrestrial natural heritage system should receive priority attention for protective municipal land use policies and restoration of natural cover. High volume groundwater recharge areas in this subwatershed are important for drinking water source protection as well as aquatic species, and should be incorporated into local natural heritage systems, where possible.

Much of the lower part of the Main Humber, particularly Rainbow Creek subwatershed, is designated for urban development, with considerable amounts of impervious surfaces associated

with industrial and commercial uses. It will be crucial to maintain a healthy water balance to protect downstream watercourses from excessive stormwater runoff, stream flows and erosion. The clay soils and thick till aquitard in this area will limit stormwater infiltration opportunities, so emphasis should be placed on green roofs and rainwater harvesting to reduce runoff and contribute to water conservation goals.

There are opportunities to provide cultural heritage themed experiences about past peoples, settlement history and present cultures in the Bolton and Kleinburg-Nashville Heritage Conservation Districts, Palgrave Mills Park and Cold Creek Conservation Area.

6.2.2 EAST HUMBER SUBWATERSHED

While most of the headwaters of the East Humber subwatershed are in the Oak Ridges Moraine and protected by legislation, much of the subwatershed will experience considerable urbanization in coming decades. As recommended for the Main Humber, the lands in the target terrestrial natural heritage system that are in areas designated for development should be protected through local land uses policies and strategic acquisitions. Natural cover should be restored, focusing on targeted lands in the Upper East, King Creek and Purpleville Creek subwatersheds that are in need of improvements to quality and connectivity of natural cover patches and where urban growth is planned.

To manage the water balance, new or improved stormwater management controls focusing on infiltration should be applied, wherever feasible. In much of the Purpleville Creek subwatershed, which has clay soils and thick till aquitard, the emphasis should be on engineered infiltration measures, green roofs and rainwater harvesting, and wetland restoration.

Aquatic habitats should be enhanced to improve populations of targeted fish species, including brook trout and redside dace, in small tributaries of Purpleville Creek and the Upper East Humber.

New trails, greenspace and cultural heritage experiences, especially along the historic Carrying Place Trail route, should be provided to increase public recreation and education opportunities.

6.2.3 WEST HUMBER SUBWATERSHED

In contrast to the Main and East Humber, the West Humber subwatershed has its headwaters in the South Slope of the Moraine, with much less countryside protected by Greenbelt legislation. Urban development is planned for areas that have many small headwater drainage features, so it will be important to assess their function with regard to water management and aquatic habitat as part of the land development process and determine appropriate treatment.

Efforts to protect and restore natural cover should focus on designated natural heritage system lands in existing developments, approved urban growth areas and protected countryside areas in the Greenbelt. Restoration of wetlands should be undertaken where opportunities exist.

Most of the remaining subwatershed is in the Peel Plain with poorly drained clay and clay till soils, limited groundwater recharge and low baseflow, especially in the summer months. In these areas innovative engineered infiltration measures, rainwater harvesting and green roofs will be valuable tools to avoid increasing surface runoff during development, and reduce erosion problems at existing sites in the City of Brampton and the City of Toronto. Existing end-of-pipe

stormwater facilities should be retrofitted, as identified in the City of Toronto's *Wet Weather Flow Management Plan*.

Aquatic habitats should also be enhanced to improve populations of targeted fish species, focusing on redside dace.

Additional greenspace lands should be acquired to link the City of Brampton and the Town of Caledon trail systems and meet the recreation needs of the growing population.

There are opportunities to provide cultural heritage themed experiences at Claireville Conservation Area.

6.2.4 BLACK CREEK SUBWATERSHED

The Black Creek subwatershed is almost completely developed. Most of this development preceded the adoption of stormwater quantity and quality controls, and environmental conditions are generally poor, with some serious flooding and erosion concerns. The emphasis here is on rehabilitation and enhancement, with an emphasis on improvements to stormwater management, riparian plantings, naturalized landscaping and street trees. The City of Toronto's *Wet Weather Flow Management Plan* and the City of Vaughan's *Stormwater Retrofit Study* provide valuable direction for improvements to stormwater management, including retrofits and new stormwater facilities, as well as measures to address combined sewers and connected downspouts.

Opportunities will exist to demonstrate sustainable community and green building designs in new developments (e.g., Vaughan Corporate Centre and OPA 620) and redevelopment projects (e.g., Photography Drive in the City of Toronto).

There are opportunities to complete missing links in the trail system and create new trails along hydro corridors.

6.2.5 LOWER HUMBER SUBWATERSHED

The Lower Humber subwatershed is entirely developed and, similar to Black Creek, has very few modern stormwater controls. Priorities in the Lower Humber are to acquire land for new stormwater controls, retrofit end-of-pipe facilities (as identified in the City of Toronto's *Wet Weather Flow Management Plan* and the City of Vaughan's *Stormwater Retrofit Study*), undertake remedial works for combined sewers, mitigate in-stream barriers and undertake riparian plantings in areas lacking natural cover.

Further habitat restoration work in the Humber Marshes is recommended.

There are opportunities to extend the Granger Greenway south from Boyd Conservation Area through Woodbridge to connect to the City of Toronto regional trail system.

There are opportunities to provide themed experiences about past peoples, settlement history and present cultures in the Old Mill area, Rousseau site, Baby Point area, Eglinton Flats area and Weston Heritage Conservation District.

Continuing efforts to remove exotic invasive species of plants is also recommended.

6.3 LAND SECUREMENT

In general terms, land securement refers to the act of bringing lands into public ownership or otherwise securing the assurance of their protection through private landowner agreements. Land securement tools include planning/policy (e.g., *Planning Act*, *Conservation Authorities Act*), stewardship (e.g., landowner agreements and education), and acquisition (such as securing land through title, easements and covenants on title).

The following priorities should be used to guide securement activities within the target terrestrial natural heritage system:

1) Locations in potential urban growth areas
2) Locations in the Protected Countryside Areas of the *Greenbelt Plan* and ORMCP and rural areas of the *Niagara Escarpment Plan*
3) Natural Core and Natural Linkage Areas designated in the ORMCP
4) Areas of redevelopment in existing urban areas

There are a number of groups active in land securement activities in the Humber watershed and there are further opportunities for partnerships among these groups. Within the next five years, the securement groups should review their programs and consider ways to secure the 1.2 per cent (446 hectares) of the targeted system in the watershed currently not protected from urban development by policy mechanisms.

This plan also recommends securement of lands, especially during redevelopment activities, to allow streams to evolve naturally. This will reduce the need for engineered methods to protect property and infrastructure from erosion and flooding. It also recommends lands be secured to enable expansion of the system of inter-regional trails, to create a northern gateway to the greenspace system of the Humber watershed, and to create additional public greenspace around growing communities.

The *Humber River Watershed Plan Implementation Guide* includes further detail regarding recommended securement projects over the next 10 years.





6.4 STEWARDSHIP AND EDUCATION

A recurring theme in this plan is the need for initiatives to increase awareness and provide more information about ways that individuals, businesses and governments can contribute to a healthy, sustainable Humber watershed. The overall theme for stewardship and education programs is to encourage behavioural shifts to sustainable practices. This can include

- Energy conservation, water conservation and waste reduction
- Organic lawn care
- Landscaping with native, drought-tolerant trees, shrubs and wildflowers
- Lot level stormwater management (e.g., rain gardens, rain barrels and permeable pavements)
- Pollution prevention
- Spills prevention and management
- Avoidance of practices that aggravate flood risk
- Control of invasive alien species
- Production and purchase of locally grown food
- Stewardship of natural areas (including garbage clean up, community monitoring, bird boxes, tree tending, and addressing encroachment issues)
- Awareness of cultural heritage
- Erosion, sediment control and site restoration practices for construction sites
- Integrated pest management for golf courses
- Best management practices for farms and rural properties
- Marketing strategies that highlight the natural and cultural assets of the Humber River and its watershed

Tree planting
Photography by Jeff Hladun

The watershed plan also highlighted the urgency of this shift to sustainable behaviour, not just to reduce our present impact on the watershed, but to create an accepting market for innovative community designs which will be the basis of long-term growth planning and decision-making in the next five to ten years. These decisions will determine the watershed's long-term health.

The *Action Plan for Sustainable Practices for Residential and Business Sectors in the GTA* (Freeman Associates, 2006) recommends a multi-pronged marketing campaign aimed at homeowners and builders in the GTA. For businesses, a package of measures is proposed, including streamlined approvals, regulatory changes, financial incentives, information tools, awards and a corporate leaders program.

The *Humber River Watershed Plan Implementation Guide* lists stewardship and education projects in seven sections:

1) Technical knowledge transfer
2) Sustainable urban landscapes
3) Rural lands
4) Resource use
5) Heritage interpretation
6) Formal education
7) Recognition

6.5 OPERATIONS AND MAINTENANCE

Property managers responsible for operations and maintenance of public property, such as roads, parks and infrastructure, or private property, such as golf courses, cemeteries or commercial/industrial lots, should consider ways they can incorporate the watershed plan directions into their ongoing practices and programs. For example, naturalization schemes can be adopted as part of landscaping practices and contribute to improved lot level water management and the achievement of our terrestrial natural heritage goals.

Maintenance recommendations are noted in many of the strategies, however, there are two significant recommendations for new formalized maintenance programs. First, our water strategies underscore the need for municipal operation and maintenance programs for stormwater management infrastructure, including the clean out of accumulated sediment in ponds. Routine maintenance activities may present opportunities to optimize the performance of these stormwater management facilities by minor adjustments in operation. Larger maintenance projects may represent cost-efficient opportunities to undertake major retrofit projects to improve facility performance.

The second new operations program being recommended relates to public lands in the Humber watershed. The nature-based recreation strategies identify the need for operational agreements for these lands, particularly regarding responsibility and funding for operations, maintenance and enforcement.

The *Humber River Watershed Plan Implementation Guide* lists implementation projects for these and other operations and maintenance issues.

6.6 ENFORCEMENT

Public education and awareness must be complemented by rigorous and co-ordinated enforcement. The *Humber River Watershed Plan* has determined that the enforcement capacities of the agencies (e.g., TRCA, municipalities, MNR, MOE and DFO) are inadequate and should be increased. The *Humber River Watershed Plan Implementation Guide* lists recommended actions:

- Identify and secure necessary resources.
- Investigate means to improve partnering among relevant agencies.
- Post signage using universal symbols or in multiple languages about permitted and non-permitted activities.
- Promote public awareness of who to call and facilitate referrals of mis-directed calls.
- Adopt protocols for feedback to the public on actions taken.

6.7 MONITORING

On-going monitoring will be essential to identify whether the management strategies in this watershed plan are effective and adapt them if necessary. For example

- Are the management measures performing as designed?
- How are environmental conditions responding?
- Do we need to change our strategies and, if so, how?

A wide range of monitoring and research activities is undertaken in the watershed. The Regional Watershed Monitoring Program, lead by TRCA in partnership with its member municipalities and other monitoring groups, is the primary mechanism to co-ordinate these activities. During the preparation of the watershed plan, a number of data gaps were identified, suggesting the need for more monitoring sites, new protocols and additional studies. There is also a need to evaluate innovative technologies and develop an adaptive management program that will use feedback from monitoring activities to make adjustments to policies, plans and programs to ensure continued progress toward the objectives of this plan.

Specific actions to improve monitoring programs are listed in the Water Strategy 10 in Section 5.3.1, and in the Humber River Watershed Plan Implementation Guide, in three broad areas:

1) Evaluation of innovative technologies
2) Ambient watershed conditions and long-term trends
3) Adaptive management

Adaptive management

An adaptive management process for a watershed uses feedback from environmental monitoring to assess how well actions are meeting desired goals and targets. If necessary, adjustments are then made to policies, plans and programs to improve performance. A typical adaptive management process involves stakeholders in specific steps:

- Plan
- Implement
- Monitor and report
- Review and evaluate
- Repeat the process with appropriate adaptations to management approaches

See also Figure 1–3 Watershed Planning Process.

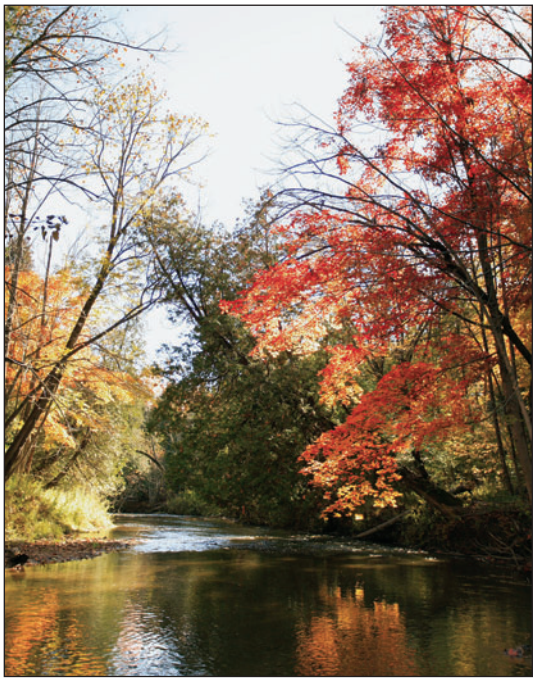
Monitoring water flows

Stream monitoring at Taylor Pond
Photography by Jeff Hladun

CHAPTER 7

7.0 CONCLUSIONS

This plan is founded on a comprehensive and ambitious set of objectives and targets for a healthy and sustainable Humber River watershed. They were developed to ensure that the valuable resources and opportunities of the Humber watershed would be protected, restored and enhanced for current and future generations of people, as well as for wildlife and their habitats. They are also intended to reverse and prevent the deterioration of environmental quality and losses of natural and cultural heritage that are apparent in the watershed.



Photography by Jeff Hladun

The initial steps in the development of the plan were to understand current conditions in the Humber watershed ecosystem, assess the effects of human activities to date, consider potential future scenarios and analyze the likely effectiveness of a range of management approaches. This process resulted in some **key findings**.

First, it is clear that the **Humber River watershed is an extraordinary resource**. It spans 903 square kilometres, from the headwaters on the Niagara Escarpment and Oak Ridges Moraine down through fertile clay plains to the marshes and river mouth on Lake Ontario. Natural areas cover about 32 per cent of the watershed, and support a rich natural heritage with cold water trout streams, headwater wetlands, kettle bogs and lakes, coniferous swamps, sugar maple forests and cool water streams supporting redside dace. There are many opportunities for nature-based recreation, with approximately 8,655 hectares of publicly-owned greenspace and about 213 kilometres of trails. The human heritage is also significant, including many archaeological and historic sites, landscapes, stories and artifacts from earlier inhabitants as well as the diverse cultures of present day communities. All these assets contributed to the designation of the Humber as a Canadian Heritage River.

Second, the analysis of current conditions showed that **conventional urban development has resulted in harmful changes** to water balance, water quality, natural cover, aquatic and terrestrial communities, cultural heritage and air quality. These changes include increased surface runoff, more water pollution, greater annual flow volumes in rivers and streams, increased erosion and sedimentation, channel instability, smog, and losses of cultural heritage and biodiversity. Rehabilitation of infrastructure and restoration of natural habitats to address these issues is underway, but is expensive and time consuming.

Third, the modelling and analysis of scenarios predicted that **if future development proceeds with current approaches** to community design and stormwater management, it will not be possible to maintain current conditions, let alone improve them. Instead, we can expect additional deterioration of environmental conditions and associated quality of life. Further, the analysis showed that even if the most innovative sustainable community measures are applied, this deterioration cannot be completely prevented throughout the watershed. The anticipated effects of climate change may exacerbate these concerns.

It is clearly neither responsible nor sustainable to continue developing the watershed without some significant changes to the design, pace and extent of new developments. Fortunately, there are many positive and practical opportunities to make these changes.

This plan recommends that all development, in greenfield areas as well as intensification of existing urban areas, should include a full suite of sustainable community measures. The *Development of a Sustainable Community Scenario for the Rouge River Watershed* report and the *Humber River Watershed Scenario Modelling and Analysis Report* provide a starting point by describing sustainable community attributes and measures. It will be essential to facilitate adoption of new technologies, test their effectiveness in meeting watershed objectives, involve the public in evaluating the results, and make changes to improve performance when necessary.

It will take time to measure and evaluate success, therefore it is recommended that development should proceed with caution and at a pace that allows opportunities to make any necessary adjustments, investigate new methods, and update the requirements for the next phases of development.

With this approach in mind, a wide range of measures are recommended to protect and enhance valued resources, regenerate damaged systems, and build more sustainable communities. This will help to increase the resilience of natural systems to human activities and climate change. It will also create healthier places for people and wildlife and stronger support for economic activities.

The **recommended management strategies** fall into three integral management directions:

1) **Protect and expand the terrestrial natural heritage system**
   Figure 5–2 illustrates an expanded natural heritage system that provides multiple benefits including improved biodiversity, water management, opportunities for nature-based recreation, improved quality of life and greater resilience to environmental impacts from urban growth and climate change. This system can be accomplished by protecting existing valued assets, securing additional lands, regenerating degraded areas and improving stewardship of public and private lands. The first priority should be targeted lands in potential urban growth areas outside the Niagara Escarpment, Oak Ridges Moraine and Greenbelt (the "whitebelt"). The second priority is targeted lands in the

protected countryside areas of the *Greenbelt Plan* and *Oak Ridges Moraine Conservation Plan* and the rural area of the *Niagara Escarpment Plan*. The third priority is in natural core and linkage areas of the *Oak Ridges Moraine Conservation Plan* and natural areas of the *Niagara Escarpment Plan*.

2) **Build sustainable communities**
More sustainable approaches to urban form, infrastructure, transportation and resource use are proposed in order to contribute to increased environmental integrity and quality of life. They should be applied to new communities as well as to the intensification or redevelopment of existing ones. Some of the key features include minimized impervious cover, measures to maintain or restore pre-development water balance, design features to facilitate sustainable choices (e.g., energy conservation, reduced vehicle use, support for local agricultural products) and protection and adaptive re-use of cultural heritage features. Application of erosion and sediment control measures must be improved to protect watercourses, especially in areas of intense urban growth. Development should be designed to proceed at a pace and extent that allows sufficient time to adopt, test and evaluate the effectiveness of new technologies and to make adjustments if the results do not meet the objectives and targets for the watershed plan.

3) **Recognize the distinctive heritage of the Humber through an enhanced regional open space system**
The Humber watershed has the basis for a significant, linked regional open space system including inter-regional trails, conservation areas, major municipal parks and cultural heritage features and landscapes. Greater collaboration is needed between public and private sector partners to improve links between nature-based recreation and cultural heritage destinations and experiences and to facilitate better planning and management of the system. This system should be further developed to reach its potential to provide nature-based recreation and cultural heritage experiences for a growing population and support healthy communities, links with local neighbourhoods and connections to surrounding watersheds and regions. The status of the Humber as a Canadian Heritage River is a remarkable designation that should be promoted. Completion of a contemporary trail along the historic Carrying Place Trail portage route that follows a spectacular river valley system would help to highlight and connect people with the natural and cultural heritage assets of the watershed.

To accomplish the management strategies, a **collaborative, integrated approach** is required. This begins with increased awareness to ensure that watershed residents, businesses, developers and agencies understand the importance of the watershed, its water cycles, natural systems and cultural heritage. This will require a long-term outreach program to provide information and understanding, explain how people can act on this knowledge, and inspire action. The results of the social marketing study, *Action Plan for Sustainable Practices*, are encouraging. The study shows that there is a modest basis of understanding and support for sustainability, but the public needs more specific information, marketing campaigns and assistance to inspire action. It also highlighted a number of barriers that reduce opportunities for businesses to adopt sustainable practices, so the plan recommends the removal of barriers and the provision of incentives for the business community.

The coordinated efforts of government agencies and community leaders are also crucial to the success of this Watershed Plan. They have many complementary tools available, including plans

and policies, permits and regulations, enforcement, infrastructure operations and maintenance, stewardship and regeneration programs, and education and awareness initiatives. More details about how these existing tools can be used to help implement the Watershed Plan are provided in the accompanying *Humber River Watershed Plan Implementation Guide*.

Many challenges lie ahead on the pathway to a healthy, sustainable Humber watershed. It is clear that a "business-as-usual" approach to future development will result in continued losses of environmental quality, biodiversity and cultural heritage, along with considerable costs to address the health, social and economic consequences of degraded environmental conditions. In contrast, this plan recommends new approaches be taken to create a better future, with healthy natural systems and a rich natural and cultural heritage supporting a high quality of life for our communities. With the guidance offered in this plan and concerted efforts by all watershed partners, a healthy and sustainable Humber River watershed is within reach.

The Humber River at Scarlett Mills Park in the City of Toronto.
Photography by Dean Young

APPENDIX A: *Humber River Watershed Plan* Objectives, Indicators and Targets

Component	Objective	Indicator	Target
Stream form	1. Protect the form and function of the Humber River and its tributaries	Channel morphology	Maintain or restore natural channel structure and rates of morphologic change (baselines to be established for RWMP sites)
		Erosion indices and stream flow regime	Maintain or restore pre-development erosion indices and stream flow regime (based on long-term stream gauge measurements and additional gauges recommended for installation; see TRCA, 2008i for baseline stream flow regimes)
		Natural cover in stream corridors	Greater than 75 per cent of riparian areas with natural cover
		Risk to public and private property from channel erosion and evolution	Reduce or eliminate infrastructure, buildings and other property at risk (database of existing infrastructure and properties at risk to be developed)
Groundwater	2. Protect groundwater recharge and discharge	Groundwater levels	No negative trend in aquifer water levels (as indicated by hydrographs from monitoring wells, see TRCA, 2008f)
		Groundwater recharge	Maintain baseline groundwater recharge rates and distribution (see Figure 3–5 and TRCA, 2008f)
		Groundwater discharge	Maintain baseline average annual baseflow rates (as determined by baseflow separation of long-term stream flow gauge data, see TRCA, 2008i)
	3. Prevent groundwater contamination	Groundwater chemistry and bacteria	The more stringent of MOE *Ontario Drinking Water Standards* or MOE *Provincial Water Quality Objectives* (as indicated by samples from monitoring wells, see TRCA, 2008f) Maintain or reduce chloride levels (as indicated by samples from monitoring wells, see TRCA, 2008f)
Surface water	4. Protect and restore the natural variability of annual and seasonal stream flow	Stream flow	Maintain or reduce baseline annual and seasonal flow volumes (based on long-term stream gauge measurements, see TRCA, 2008i)
	5. Maintain and restore natural levels of baseflow		Maintain or enhance baseline seasonal and annual baseflow rates (see TRCA, 2008i)

Component	Objective	Indicator	Target
Surface water Continues	6. Eliminate or minimize risk to human life and property due to flooding	Flooding	Maintain or reduce existing peak flows for two to 100 year return period events (see Aquafor Beech Limited, 2002) Reduce or maintain baseline number of flood vulnerable areas and roads (based on most recent update to TRCA database, see TRCA, 2008i)
	7. Protect and restore surface water quality with respect to toxic contaminants and other pollutants such as sediment, nutrients, bacteria and road salt	Conventional pollutants	Levels of conventional pollutants in the Main, East and West Humber subwatersheds meet more stringent of *Provincial Water Quality Objectives* or *Federal Water Quality Guidelines* for at least 85 per cent of the samples. Levels of conventional pollutants in the Lower Humber and Black Creek subwatersheds meet more stringent of *Provincial Water Quality Objectives* or *Federal Water Quality Guidelines* for at least 75 per cent of the samples.
		Bacteria	Bacteria levels in the Main, East and West subwatersheds meet *Provincial Water Quality Objectives* - 100 coliforms/100 mL more than 60 per cent of the time. Bacteria levels in the Lower Humber and Black Creek subwatersheds meet *Provincial Water Quality Objectives* - 100 coliforms/100 mL more than 50 per cent of the time. Lake Ontario waterfront beaches are open to swimming more than 70 per cent of the season.
		Heavy metals and organic contaminants	Levels of heavy metals and organic contaminants meet more stringent of *Provincial Water Quality Objectives* or *Federal Water Quality Guidelines* at least 90 per cent of the time. Banned priority toxic substances are detected in less than 10 per cent of samples. Persistent organic contaminant levels in young-of-the-year fish meet IJC and CCME guidelines. Restrictions on sport fish consumption have not increased from 1999 levels.
	8. Manage stormwater to protect people and the health of streams and rivers	Stormwater management	Increase portion of urban area with stormwater quantity, quality and erosion controls (see TRCA, 2008i)

Component	Objective	Indicator	Target
Air	9. Reduce air pollution to levels that protect human health, natural ecosystems and crops, and does not exacerbate global climate change	Air chemistry	Air Quality Index (AQI) of "very good" (does not exceed 15) in 100 per cent of annual sampled hours No smog advisories are issued
Aquatic system	10. Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species 11. Provide for sustainable fishing opportunities and the safe consumption of fish	Benthic invertebrates	Minimum of 70 per cent of RWMP sites rated as "fair" or "good" based on benthic invertebrate indices
		Fish communities	All RWMP sites upstream of urban development rated as "good" based on Index of Biotic Integrity (IBI) scores RWMP sites in urban areas should maintain or improve over baseline conditions (see TRCA, 2008c) Maintain or restore target fish communities (see Figure 5-1)
		Aquatic habitat	Only strategic in-stream barriers remain; barriers removed/mitigated in priority sequence as identified in the *Humber River Fisheries Management Plan* (MNR and TRCA, 2005) Increase wetland cover to 10 per cent of total watershed area Greater than 75 per cent of riparian areas with natural cover (60 per cent forest or successional; 15% meadow or wetland)
		Invasive and exotic species	Prevent the introduction of any invasive or exotic species
		Consumption of sport fish	Restrictions on sport fish consumption have not increased from 1999 levels.

Component	Objective	Indicator	Target
Terrestrial system	12. Protect, restore and enhance natural cover to improve connectivity, quality, biodiversity and ecological function 13. Minimize the negative influences from surrounding land uses on terrestrial system quality and function	Quantity of natural cover	Increase natural cover to at least 39 per cent of total watershed area (see Figure 5–2 and TRCA, 2008k) Increase wetland cover to 10 per cent of total watershed area
		Quality and distribution of natural cover	Average habitat patch total quality rating of "good" for all patches in, or partially within, the watershed (see TRCA, 2008k); and as follows for primary subwatersheds: Main Humber – good East Humber – good West Humber – fair Lower Humber – poor Black Creek – poor
		Disturbances in natural areas	Maintain or reduce baseline ratios of severely disturbed area to total evaluated area (see TRCA, 2008k)
		Biological diversity	Maintain or improve baseline representation of native vegetation community types and species (baseline to be determined through RWMP natural heritage inventories) Maintain or improve baseline abundance and distribution of native vegetation community types and species (baseline to be determined through RWMP natural heritage inventories)
Cultural heritage	14. Identify, document, protect and conserve cultural and heritage resources	Cultural heritage resources	Increase number of known, Listed and Designated archaeological and historical sites and built heritage features (see TRCA 2008d) Locations of all known mill sites have been documented and field verified.
	15. Celebrate the diverse culture and heritage resources of the Humber Watershed	Awareness of culture and heritage	Increase watershed residents' awareness that the Humber is a Canadian Heritage River (*see Pollara Strategic Public Opinion and Market Research*, 2006 for baseline assessment)
	16. Identify and promote the economic value of cultural and heritage resources	Not applicable	Not applicable

Component	Objective	Indicator	Target
Nature-based recreation	17. Incorporate greenspace in all urban and rural developments and create an accessible and connected greenspace system that is compatible with ecological and cultural integrity	Quantity of public greenspace	Increase quantity of public greenspace (see TRCA, 2008h) Public greenspace is located within two kilometres of all homes.
		Management of public greenspace	Manage 100 per cent of public greenspace through application of standards of best practice.
	18. Develop a system of inter-regional trails, and local and regional nature-based recreation, education and tourism destinations within the greenspace system	Trails	An additional 60 kilometres of inter-regional trails are built in the watershed (see Figure 5–3 and TRCA, 2008h). Increase connectivity between inter-regional and local trails
		Nature-based recreation, education and tourism destinations	Increase number of local and regional destinations in West and East Humber subwatersheds (see TRCA, 2008h) Provide opportunities for nature-based recreation experiences related to the following concept areas or themes: - Kettle lakes - Hills of the headwaters - Humber Valley wilderness - Urban escape - Black Creek parklands - Humber Bay parklands
Land use	19. Protect the form and function of landforms such as the Niagara Escarpment, Oak Ridges Moraine and South Slope	Significant landforms	No additional land on the Niagara Escarpment and Oak Ridges Moraine is developed beyond what has been committed in municipal official plans for development as of 2005
	20. Balance economic development with protection of the environment and society 21. Improve sustainability in urban form at community and building site scales	Community design	To be determined
		Transportation	Increase annual number of transit trips per person (based on Municipal Performance Measurement annual reports, also see TRCA, 2008g)
			Decrease the percentage of trips made by car, truck or van as driver (based on Municipal Performance Measurement annual reports, also see TRCA, 2008g)
		Green buildings	All new or renovated public buildings are designed to achieve green building certification (e.g., Leadership in Energy and Environmental Design - LEED)

Component	Objective	Indicator	Target
Land use continues	22. Protect and enhance the integrity and economic viability of agricultural areas	Local food purchasing	Public facilities, including schools, meet 20 per cent of their food needs with production from Ontario farms and community gardens
		Agricultural industry vitality	Maintain or increase net farm income (baseline is 2001 census)
Resource use	23. Practise sustainable resource use by individuals, households, businesses, institutions and governments 24. Use ground and surface water at sustainable rates	Water demand	Meet municipal targets for reduction in projected water demand Reduce peak and average day demand by at least 10% of projected levels (based on City of Toronto, 2002; Veritec Consulting Inc., 2004; Resource Management Strategies Inc., 2007)
		Water use restrictions	No restrictions in use arising from low aquifer water levels
		Surface water withdrawals	Portion of mean annual baseflow allocated for withdrawal is less than 10 per cent (see TRCA, 2008i)
		Solid waste diversion	Meet municipal targets for residential waste diversion from landfill: - 60 to 75 per cent diversion of household wastes in the Regional Municipality of York (MacViro Consultants and Jacques Whitford Ltd., 2006) - 70 per cent diversion of household wastes in the Regional Municipality of Peel by 2016 (Peel Region, 2003) - 100 per cent diversion of household wastes in the City of Toronto by 2010 (City of Toronto, 2001b) (also see TRCA, 2008h)
		Energy sources and demand	Meet Province of Ontario target of 34 per cent of electricity supply from renewable sources by 2025 (Ontario Ministry of Energy, 2007)
			Reduce per capita energy demand by 15 per cent per year

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APPENDIX C: Glossary

Adaptive management: The use of feedback from monitoring activities to make adjustments to policies, plans and programs to ensure that goals, objectives and targets are met.

Air Quality Index: An indicator of air quality based on hourly ambient concentrations of six key pollutants that are known to have adverse effects on human health and the environment: sulphur dioxide, ozone, nitrogen dioxide, total reduced sulphur compounds, carbon monoxide and suspended particles.

Aquatic system: An ecological unit composed of living (e.g., fish, insects, amphibians, reptiles and plants) and non-living (e.g., sediment, woody and rocky materials) elements, and related ecological processes that interact in an aqueous medium (e.g., rivers, lakes and wetlands).

Aquifer: A body of permeable rock saturated with water and through which groundwater moves.

Aquitard: A body of low permeability rock that inhibits the movement of groundwater.

Archaeological resources: The remains of any building, structure, event, activity, place or cultural feature or object which, because of the passage of time, is on or below the surface of the land or the water and which is associated with Aboriginal history (pre AD 1608) or the post-contact (historic) period (post AD 1608) in Ontario.

Architectural resources: Buildings, structures, or remains built by people which reveal some of the broad architectural, cultural, social, political, economic or military patterns of Ontario's Euro-Canadian history or are associated with specific events or people that have shaped Euro-Canadian history.

Baseflow: The component of stream flow that comes from groundwater sources.

Baseline: Initial conditions from which deviations are assessed.

Benthic invertebrates: Organisms that live near or at the bottom of streams or lakes for at least part of their life cycle, including crayfish, leeches, clams, snails and the larval stages of insects.

Biodiversity: Biodiversity (biological diversity) is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Secretariat of the Convention on Biological Diversity, 2003).

Carrying capacity: The ability of air, land, and water to absorb the impacts of human activities.

Cultural heritage landscape: Any discrete aggregation of features made by people where their spatial arrangement is representative of distinct cultural processes associated with present and historical use of the land. Cultural landscapes include such features as a neighbourhood, a townscape, landscape or waterscape (see also historic landscape).

Ecological footprint: A resource management tool that measures how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes under prevailing technology.

Ecosystem management: An approach that addresses environmental, social, cultural and economic issues and focuses on their linkages, relationships and dynamic nature.

End-of-pipe stormwater management: Constructed facilities such as ponds or wetlands that receive stormwater at the end point of a conveyance system such as a ditch or sewer and control its flow and quality before it reaches the stream or lake.

Eutrophic: Fresh waters that are highly productive and often display overgrowth of algal or aquatic plant growth as a result of an abundant supply of nutrients (e.g., phosphorus and nitrogen).

Evaporation: Water that leaves the surface water flow system and enters the atmosphere as water vapour.

Evapotranspiration: Water that leaves the soil zone and enters the atmosphere as water vapour through both evaporative and plant-based mechanisms.

Fish Management Zone: An area of the watershed that exhibits or has relatively homogeneous hydrogeological characteristics and ecological functions and supports a characteristic fish community.

Fluvial: Relating to a stream or river.

Fluvial geomorphology: The study of landform evolution related to flowing watercourses and the physical forms and processes of rivers and streams.

Glaciation: The covering of an area or the action on that area, by an ice sheet or by glaciers.

Groundwater: Water that exists below the earth's surface in the spaces between soil grains or in open spaces in rock.

Groundwater discharge: Water that flows from an aquifer into the surface water system.

Habitat patch: A contiguous (or unbroken) extent of one habitat type, such as forest, wetland or meadow.

Heritage conservation district: Any aggregate of buildings, structures and open spaces that, as a group, is a collective asset to the community and which may have architectural, historical, archaeological or scenic value. Districts may be found in urban and rural environments, and may comprise residential, commercial or industrial areas, landscapes or entire villages. Heritage conservation districts are designated by municipal by-law, under Part V of the *Ontario Heritage Act*.

Historic landscape: Considered a subset of the cultural landscape, but is differentiated by historical merit including a specific association to historical events, people, heritage building(s)/ structures or archaeological sites.

Index of biotic integrity: An ecologically-based index to measure "stream health" that uses fish community data and summarizes them in four categories: species richness, trophic composition, local indicator species and fish abundance.

Infill: Development on available land within an urban area rather than on new undeveloped land outside the city or town.

Infiltration: Water entering the pores of the earth's surface.

Lacustrine: Pertaining to a lake.

Lot level stormwater management: Controls that are applied at the individual residential, commercial, industrial or institutional lot level to detain, infiltrate, or evaporate stormwater. Sometimes referred to as *source controls,* these measures are intended to reduce peak runoff rates, provide water quality treatment, and maintain the pre-development water balance.

Matrix influence: The surrounding land use context for natural habitats. It influences the value of the habitat to native species through such influences as predation, competition, disturbance and encroachment.

Meander: A loop-like bend in a stream or river that develops when a watercourse flows through level land and erodes its flood plain.

Naturalization: The conversion of urban or agricultural lands to natural cover (see also restoration).

Nature-based recreation: All outdoor public recreation activities that depend on healthy, attractive, natural landscapes. They include walking, hiking, cross-country skiing, wildlife-viewing, picnicking, camping, bicycling, horseback riding, canoeing, fishing and swimming.

Precautionary principle: Takes a conservative approach and incorporates contingencies and backups on decisions involving uncertainty.

Precipitation: Water that leaves the atmosphere and enters the surface water system in the form of liquid (rain) or solid (snow, sleet, etc.).

Quadruple bottom line: An approach to reporting and accounting that considers social, economic, environmental and cultural performance, benefits and impacts. See also triple bottom line.

Rain-harvesting: Collection of rainwater for beneficial uses.

Recharge: Precipitation that enters the groundwater flow system.

Regional storm: The maximum historical rainfall on record, represented by Hurricane Hazel (1954) in the Toronto Region.

Restoration: The act of repairing or re-establishing of functioning ecosystems, which may be a native, historic ecosystem or a specified ecosystem suited to existing conditions. Passive restoration allows lands to recover without human intervention whereas active restoration is assisted by human management activities.

Riparian cover/habitat: Riparian vegetation provides habitat, food and shelter, assists in stabilizing soils and contributes to both the adjacent aquatic and terrestrial ecosystems. The riparian area is located immediately landward of watercourses or shorelines and is characterized by soils that exhibit signs of regular saturation and vegetation tolerant of periodic inundation.

Runoff: The portion of precipitation that enters the surface water flow system.

Salmonids: Fish of the fish family Salmonides; for example, salmon, trout and chars.

Sediment load: Volume of sediment carried by the stream or river.

Special Policy Area (SPA): A portion of a community that has historically existed in the flood plain and is designated to provide for the continued viability of existing uses, provided there is compliance with site-specific flood hazard management policies such as flood-proofing, flood remediation and risk reduction measures.

Species of conservation concern: Generally refers to species that are disappearing from the regional landscape, primarily as a result of land use changes.

Stormwater: Rain and snowmelt that runs off urban surfaces such as roads, roofs, and paved areas and that may be conveyed by engineered drainage systems to lakes and rivers.

Stormwater retrofit: Installation of new stormwater management measures or upgrades to existing infrastructure at the lot level, conveyance system or end-of-pipe, in order to improve the level of stormwater management

Subwatershed: A region or area bounded peripherally by a water parting and draining ultimately to a tributary of a larger watercourse or body of water.

Surface water: Precipitation which does not soak into the ground or return to the atmosphere by evaporation or transpiration and is stored in, and flows through, streams, lakes, wetlands and reservoirs.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their needs.

Target species: Species or assemblage of species which are primarily sought in a fishery. Species in an aquatic system that are most sensitive to change, such that management for their survival will also ensure the health of the rest of the community.

Target terrestrial natural heritage system: Existing natural cover plus potential natural cover as delineated in the management strategy (Chapter 5), intended to meet biodiversity objectives.

Transpiration: The process whereby water leaves plant tissues by evaporation through small openings called stoma.

Triple bottom line: An approach to reporting and accounting that incorporates performance in societal, environmental and economic terms, recognizing the interdependence of these three elements. See also quadruple bottom line.

Water budget: A summary of the quantity of water in the atmosphere, the surface water flow system and the groundwater flow system within a watershed that can be examined on any time scale (from hourly to annually).

Water balance: This term is often used interchangeably with water budget. More correctly, water balance applies to the concept of maintaining the various water budget components after urban development. For example, if the baseline recharge for a site is 150 millimetres per year, maintaining the water balance would require the post development recharge for the site to be 150 millimetres per year.

Watershed: The total area of land that drains to a river or other large body of water.

Whitebelt: Potential future urban growth areas not yet designated for urban settlement in municipal official plans and not within the boundaries of the province's Greenbelt Plan.

APPENDIX D: Scenarios

Humber watershed scenarios selected for analysis

Scenario #	Scenario name	Description	Rationale
1	Current conditions	Land use/cover and water use conditions that existed in 2002	Provides a baseline for comparison
2	Approved official plan build-out	Implementation of official plan land use schedules (approved as of January 1, 2005) with conventional stormwater management practices and protection of the valley and stream corridor	Examine watershed response to approved urban growth assuming current policies and best management practices are implemented
3	Approved official plan build-out with stormwater retrofits	Implementation of approved official plan land use schedules along with the City of Toronto's *25 year Wet Weather Flow Management Plan* and stormwater pond retrofits in "905" area municipalities	Examine effect of implementing new or improved stormwater controls in existing urban areas on watershed response to approved urban growth
4	Approved official plan build-out with expanded natural cover	Implementation of approved official plan land use schedules along with TRCA *Terrestrial Natural Heritage Strategy*	Examine effect of increasing the quantity of natural land cover in targeted areas on watershed response to approved urban growth
5	Full build-out	Implementation of approved official plan land use schedules (approved as of September 1, 2006) plus development of all lands not currently protected from urban growth by provincial or municipal policies, with conventional stormwater management practices and protection of the valley and stream corridor	Examine watershed response to the greatest extent of urbanization possible under current provincial policies
5A	Full build-out with warmer and wetter climate	Same land use/cover and water use assumptions as in scenario 5 with a 2080 climate, as predicted by the CGCM2 model, scenario A21 (5 °C warmer and 6 per cent wetter than recent average annual conditions)	Examine watershed response to the greatest extent of urbanization possible and a warmer and wetter climate
5B	Full build-out with warmer and much wetter climate	Same land use/cover and water use assumptions as in scenario 5 with a 2080 climate, as predicted by the Hadley CM2 model, scenario A1F1 (7 °C warmer and 19 per cent wetter than recent average annual conditions)	Examine watershed response to the greatest extent of urbanization possible and a warmer and much wetter climate

Scenario #	Scenario name	Description	Rationale
6	Sustainable communities	Implementation of official plan land use schedules (approved as of September 1, 2006) plus development of all lands not currently protected from urban growth by provincial or municipal policies but with low impact development designs, TRCA *Terrestrial Natural Heritage Strategy*, and improvements to stormwater management in new and existing urban areas	Examine the effect of aggressive implementation of sustainable community design concepts and enhanced stormwater management on watershed response to full build-out
6A	Sustainable communities with warmer and wetter climate	Same land use/cover and water use assumptions as in scenario 6 with a 2080 climate, as predicted by the CGCM2 model, scenario A21 (5 °C warmer and 6 per cent wetter than recent average annual conditions)	Examine the watershed response to full build-out with sustainable community design and a warmer and wetter climate
6B	Sustainable communities with warmer and much wetter climate	Same land use/cover and water use assumptions as in scenario 6 with a 2080 climate, as predicted by the Hadley CM2 model, scenario A1F1 (7 °C warmer and 19 per cent wetter than recent average annual conditions)	Examine the watershed response to full build-out with sustainable community design and a warmer and much wetter climate

APPENDIX E: List of Supporting Documents

Implementation guide

Toronto and Region Conservation Authority. 2008. *Humber River Watershed Plan Implementation Guide*

Supporting documents

Toronto and Region Conservation Authority. 2008. *Humber River State of the Watershed Reports – Air Quality; Aquatic System; Cultural Heritage; Fluvial Geomorphology; Geology and Groundwater Resources; Land and Resource Use; Nature-based Recreation; Surface Water Quality; Surface Water Quantity; and Terrestrial System.*

Toronto and Region Conservation Authority. 2008. *Humber River Watershed Scenario Modelling and Analysis Report.*

HCCL Ltd. 2008. *Humber River Watershed HSP-F Update and Future Scenarios Modelling.*

Toronto and Region Conservation Authority. 2007a. *Development of a Sustainable Community Scenario for the Rouge River Watershed.*

Toronto and Region Conservation Authority. 2007b. *Listen To Your River – A Report Card on the Health of the Humber River Watershed*, Prepared for the Humber Watershed Alliance.

Freeman Associates. 2006. *Action Plan for Sustainable Practices – Implementation Strategies for the Residential and Business Sectors in the Greater Toronto Area.* Toronto and Region Conservation Authority.

J.D. Power and Associates. 2006. 2006 *New Home Builder Customer Satisfaction Study – TRCA Supplemental Study.* Toronto and Region Conservation Authority.

Ontario Ministry of Natural Resources and Toronto and Region Conservation Authority. *Humber River Fisheries Management Plan*. Final Draft 2005.

APPENDIX F: Technical Support

Technical support in undertaking the *Humber River Watershed Planning Study* was provided by the following team of staff and consultants:

Toronto and Region Conservation staff:
David Burnett, Manager, Provincial and Regional Policy
Mary-Ann Burns, Planner II Policy
Bob Clay, Project Manager, Watershed Planning
Cathy Crinnion, Archaeologist
Sonia Dhir, Watershed Resources Planner
Jamie Duncan, Water Resource Data Management
Don Ford, Manager, Geoenvironmental
Noah Gaetz, Supervisor, Terrestrial Natural Heritage
Sue Hayes, Co-ordinator, Terrestrial Field Inventories
Steve Hollingsworth, Water Resource Engineer
Janet Ivey, Project Manager, Watershed Planning
Joanne Jeffery, Manager, Stewardship and Outreach Education
Cindy Kambeitz, Water and Air Quality Analyst
Margie Kenedy, Assistant Archaeologist
Lia Lappano, Administrative Clerk
Dave Lawrie, Aquatic Systems Analyst 2
Dena Lewis, Manager, Terrestrial and Aquatic Ecology
Daniela Macleod, GIS Technical Assistant
Glenn MacMillan, Senior Manager, Water and Energy
Deborah Martin-Downs, Director, Ecology Division
Deanna Cheriton, Project Manager, Land Management
Sonya Meek, Manager, Watershed Planning
Ryan Ness, Manager, Water Resources
Susan Robertson, Watershed Resources Planner
Christine Tu, Supervisor, Aquatic Management
Tim Van Seters, Manager, Sustainable Technology
Sylvia Waters, Watershed Planning Assistant
Gary Wilkins, Humber Watershed Specialist
Carolyn Woodland, Director, Planning and Development Division
Dean Young, Co-ordinator, Watershed Planning
Jehan Zeb, Assistant Hydrogeologist
Consultants:
Barrett Consulting
EarthFX Incorporated
Freeman Associates
HCCL




TORONTO AND REGION Conservation

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w w w . t r c a . o n . c a

HUMBER RIVER WATERSHED PLAN: PATHWAYS TO A HEALTHY HUMBER

At Authority Meeting #5/08, of Toronto and Region Conservation Authority (TRCA), held on June 27, 2008, Resolution #A137/08, in regard to Humber River Watershed Plan: Pathways to a Healthy Humber, was unanimously approved as follows:

WHEREAS the Province of Ontario's Oak Ridges Moraine Conservation Plan (2002) requires every upper-tier and single tier municipality to prepare watershed plans for every Oak Ridges Moraine stream that originates within the municipality's area of jurisdiction; and

WHEREAS the Toronto and Region Conservation Authority staff has completed a final draft Humber River Watershed Plan on behalf of watershed municipalities which updates the 1997 Humber River Watershed Strategy, Legacy: A Strategy For A Healthy Humber, meets watershed planning requirements of the Oak Ridges Moraine Conservation Plan (2002), and augments management direction provided by the City of Toronto's Wet Weather Flow Management Master Plan for upstream municipalities;

THEREFORE LET IT BE RESOLVED THAT the Humber River Watershed Plan, Pathways to a Healthy Humber, dated June 2008, be approved;

THAT staff be directed to work with partners to implement the plan;

THAT staff be directed to use the Humber River State of the Watershed Reports, Humber River Watershed Scenario Modelling and Analysis Report, Action Plan for Sustainable Practices and Humber River Watershed Plan Implementation Guide as reference documents to inform and guide ongoing work and long term work planning and budget preparation;

THAT copies of the Humber River Watershed Plan be circulated to municipalities within the Humber River watershed and their Councils be asked to adopt the plan and commit to work with the Toronto and Region Conservation Authority (TRCA) to implement the recommendations appropriate to their municipality;

THAT copies of the Humber River Watershed Plan be circulated to the Humber Watershed Alliance, provincial and federal governments as well as all other relevant organizations and interest groups and they be asked to provide ongoing support for the implementation of the principles, objectives and relevant recommendations of the plan;

THAT copies of the Humber River State of the Watershed Reports, Humber River Watershed Scenario Modelling and Analysis Report, Action Plan for Sustainable Practices and Humber River Watershed Plan Implementation Guide be circulated to watershed municipalities and made available to other partner organizations and they be encouraged to use these reference documents to inform and guide their ongoing work;

THAT copies of the Humber River Watershed Plan be circulated to local libraries and copies of the plan and all supporting documents be posted on the TRCA web site;

THAT staff be directed to work with watershed municipalities and other partners to develop five year workplans and budgets for top priority projects identified in the Humber River Watershed Plan Implementation Guide and incorporate them into the annual capital budget process;

THAT the revised Conformity Assessment for the Humber River Watershed Plan in Attachment 3 and the watershed planning documents referenced in the conformity assessment be deemed to fulfill the watershed planning requirements of the Oak Ridges Moraine Conservation Plan (ORMCP; 2002) and be approved for use in the review of major development proposals on the Oak Ridges Moraine and that the regional and local municipalities, Province, and Conservation Authorities Moraine Coalition (CAMC) be so advised;

THAT staff meet with representatives of the Aboriginal community to discuss the Humber River Watershed Plan and ways they wish to be involved in its implementation;

THAT the Humber Watershed Alliance assist staff with reporting on progress in the implementation of the Humber River Watershed Plan;

AND FURTHER THAT staff convene up to 3 meetings per year with municipal staff and other stakeholder representatives from the Humber watershed, and in conjunction with other watershed groups where appropriate, to facilitate partnerships and track progress in implementation.

TO: Chair and Members of the Authority
Meeting #5/08, June 27, 2008

Item 7.1

FROM: Deborah Martin-Downs, Director, Ecology

RE: **HUMBER RIVER WATERSHED PLAN: PATHWAYS TO A HEALTHY HUMBER**

KEY ISSUE
Approval of Humber River Watershed Plan and immediate steps to facilitate its implementation.

RECOMMENDATION
WHEREAS the Province of Ontario's Oak Ridges Moraine Conservation Plan (2002) requires every upper-tier and single tier municipality to prepare watershed plans for every Oak Ridges Moraine stream that originates within the municipality's area of jurisdiction; and

WHEREAS the Toronto and Region Conservation Authority staff has completed a final draft Humber River Watershed Plan on behalf of watershed municipalities which updates the 1997 Humber River Watershed Strategy, Legacy: A Strategy For A Healthy Humber, meets watershed planning requirements of the Oak Ridges Moraine Conservation Plan (2002), and augments management direction provided by the City of Toronto's Wet Weather Flow Management Master Plan for upstream municipalities;

THEREFORE LET IT BE RESOLVED THAT the Humber River Watershed Plan, Pathways to a Healthy Humber, dated June 2008, be approved;

THAT staff be directed to work with partners to implement the plan;

THAT staff be directed to use the Humber River State of the Watershed Reports, Humber River Watershed Scenario Modelling and Analysis Report, Action Plan for Sustainable Practices and Humber River Watershed Plan Implementation Guide as reference documents to inform and guide ongoing work and long term work planning and budget preparation;

THAT copies of the Humber River Watershed Plan be circulated to municipalities within the Humber River watershed and their Councils be asked to adopt the plan and commit to work with the Toronto and Region Conservation Authority (TRCA) to implement the recommendations appropriate to their municipality;

THAT copies of the Humber River Watershed Plan be circulated to the Humber Watershed Alliance, provincial and federal governments as well as all other relevant organizations and interest groups and they be asked to provide ongoing support for the implementation of the principles, objectives and relevant recommendations of the plan;

THAT copies of the Humber River State of the Watershed Reports, Humber River Watershed Scenario Modelling and Analysis Report, Action Plan for Sustainable Practices and Humber River Watershed Plan Implementation Guide be circulated to watershed municipalities and made available to other partner organizations and they be encouraged to use these reference documents to inform and guide their ongoing work;

THAT copies of the Humber River Watershed Plan be circulated to local libraries and copies of the plan and all supporting documents be posted on the TRCA web site;

THAT staff be directed to work with watershed municipalities and other partners to develop five year workplans and budgets for top priority projects identified in the Humber River Watershed Plan Implementation Guide and incorporate them into the annual capital budget process;

THAT the revised Conformity Assessment for the Humber River Watershed Plan in Attachment 3 and the watershed planning documents referenced in the conformity assessment be deemed to fulfill the watershed planning requirements of the Oak Ridges Moraine Conservation Plan (ORMCP; 2002) and be approved for use in the review of major development proposals on the Oak Ridges Moraine and that the regional and local municipalities, Province, and Conservation Authorities Moraine Coalition (CAMC) be so advised;

THAT staff meet with representatives of the Aboriginal community to discuss the Humber River Watershed Plan and ways they wish to be involved in its implementation;

THAT the Humber Watershed Alliance assist staff with reporting on progress in the implementation of the Humber River Watershed Plan;

AND FURTHER THAT staff convene up to 3 meetings per year with municipal staff and other stakeholder representatives from the Humber watershed, and in conjunction with other watershed groups where appropriate, to facilitate partnerships and track progress in implementation.

BACKGROUND

Purpose and Role of the Watershed Plan

In 2003, TRCA entered into a five year work program with York Region, Peel Region and the City of Toronto to prepare a watershed plan for the Humber River. This initiative was to assist York and Peel Region municipalities in fulfilling the Oak Ridges Moraine Conservation Plan (ORMCP) requirement to have watershed plans completed by April 2007. The study was also designed to update the 1997 watershed strategy, Legacy: A Strategy For A Healthy Humber, augment the City of Toronto's Wet Weather Flow Management Master Plan by providing direction for upstream municipalities, identify high priority remedial actions that address goals of the Remedial Action for the Toronto and Region Great Lakes Areas of Concern, and apply TRCA's vision for The Living City at a watershed scale.

The goal of the watershed planning study was to make long term strategic recommendations for the protection and enhancement of watershed health, based on an integrated understanding of watershed systems and technical analysis of issues, opportunities and management strategies and their predicted effects on the watershed. The watershed planning approach is well-recognized in legislation and local plans and policies, although it is only the ORMCP which requires municipalities to undertake watershed plans and incorporate their objectives and requirements into municipal official plans and ensure that major development on the Oak Ridges Moraine conforms with the watershed plan .

The watershed plan is intended to inform and guide municipalities, provincial and federal governments and TRCA as they update their policies and programs for environmental protection, conservation, and restoration within the contexts of land and water use, and the planning of future urban growth. The plan also provides direction to local non-governmental organizations and private landowners with regard to best management practices and opportunities for environmental stewardship.

Watershed Planning Process

At Authority Meeting #6/04, held on June 25, 2004, Resolution #A191/04 was adopted, giving approval to an overall workplan for the watershed planning study. The workplan outlined a three-phased approach, including:

1) initial scoping and characterization of current conditions;
2) analysis of current and potential future stresses on the watershed and evaluation of various management strategies; and
3) preparation of the watershed management plan and implementation framework.

Opportunities for public and stakeholder consultation throughout the process were recognized as an essential component of the work program.

The scope of technical study components addressed the core ORMCP requirements (e.g. water, natural heritage) and acknowledged that “other” study components such as cultural heritage and nature-based recreation were to be included to address local watershed interests and issues.

In 2005, the province released a series of draft technical guidelines addressing various aspects of the ORMCP, including one on watershed planning. The guidelines were finalized in 2007. The watershed planning guideline, while quite general, advocates the same planning process that TRCA and its partners have followed.

New Approaches

TRCA has been a leader in advancing the science of integrated watershed planning in order to produce state-of-the-art watershed planning products that will provide a sound basis for effective management decisions. Some of the innovative aspects of this work included:

- Modelling and analysis of the watershed’s response to future land use and management scenarios, including various extents and forms of urban growth, stormwater retrofits, expanded natural cover and climate change;

- An integrated, interdisciplinary analysis that has improved our understanding of the watershed system and its sensitivities (e.g. interaction of surface and groundwater; effects of terrestrial natural heritage on hydrology, etc.);
- Development and application of linked modelling tools to support the above-noted analysis;
- Development of a science-based methodology for prioritization of regeneration actions;
- Social marketing studies in support of more strategic implementation recommendations for lot level practices in business and residential sectors;
- Development of an Implementation Guide to accompany the Watershed Plan, including a policy component that will assist municipal planners in applying the plan's science and strategic recommendations; and
- Ongoing commitment to community engagement in the planning process.

Supporting Documents

The following principle documents support the Humber River Watershed Plan:

A series of ten (10) *Humber River State of the Watershed Reports (TRCA, 2008)* document the current watershed conditions and issues in relation to the watershed objectives, according to the theme areas: Air Quality, Aquatic System, Cultural Heritage, Fluvial Geomorphology, Geology and Groundwater Resources, Land and Resource Use, Nature-based Recreation, Surface Water Quality, Surface Water Quality, and Terrestrial System. Drafts of these reports and ratings of current conditions provided input to the 2007 Watershed Report Card, *Listen To Your River: A Report Card on the Health of the Humber River Watershed (TRCA, 2007).*

Humber River Watershed Scenario Modelling and Analysis Report (TRCA, 2008) summarizes the predicted watershed response to future land use and management scenarios. This work identified the relative effectiveness of various management strategies, and provided a basis for recommendations in the Watershed Plan.

Humber River Watershed Plan Implementation Guide (TRCA, 2008) organizes the Watershed Plan recommendations according to the relevant implementation tools and assembles additional information to inform initial action. The Guide summarizes a proposed workplan of implementation projects, within the context of existing programs and likely implementing partners.

Action Plan for Sustainable Practices – Implementation Strategies for the Residential and Business Sectors in the Greater Toronto Area (Freeman Associates, 2006), a social marketing based study which recommended strategies for accelerating the uptake and adoption of sustainable practices, with a focus on lot level stormwater management and naturalization. These key strategies were included in the Watershed Plan.

Consultation on Draft Humber River Watershed Plan and Supporting Documents

Consultation Mechanisms

TRCA staff has conducted a program of consultation for the plan. A series of seven reports and three presentations were brought to the Humber Watershed Alliance at milestone points in the watershed planning process. Copies of the first draft Watershed

Plan were sent out in June 2007 to senior study contacts within key departments of each watershed municipality, provincial and federal government agencies, the Humber Watershed Alliance and other interested stakeholders. Copies of the final draft Watershed Plan and Implementation Guide were sent out in April 2008 to the same groups. Information was provided about the availability of other supporting documents (downloadable from TRCA's web site or available upon request in hard copy or CD) and upcoming consultation sessions. An offer was extended to have TRCA staff attend meetings or provide presentations to facilitate reviews. Comments and an indication of support in principle for the Watershed Plan were requested by May 9, 2008, although this deadline was extended to June 3, 2008 in several instances.

Half-day "government" consultation sessions were held on March 30 and October 9, 2007 and April 23, 2008, involving staff representatives from watershed municipalities and provincial and federal government departments. There was general support for the strategic directions of the Watershed Plan and good dialogue about how to move forward to implementation at each meeting.

Three public open houses were held at locations around the watershed, including Caledon (November 19, 2007), Toronto (November 21, 2007) and Vaughan (November 22, 2007). A total of about 50 people attended. These sessions were advertised via notices placed in major community newspapers throughout the watershed.

Feedback Received
In summary, most of the feedback received was very supportive, acknowledging the scientific basis for the plan, the innovative and comprehensive planning approach, and the action-oriented implementation directions.

The most significant comments pertained to:
- the need for clarification of the role of the Watershed Plan, in terms of the authority under which it is to be implemented (explanatory text has been added in response to this comment);
- the need for flexibility in implementation, particularly regarding how recommendations will be incorporated into policies and programs;
- the need for further analysis and refinement of the recommended target terrestrial natural heritage system as part of planning and implementation initiatives at more detailed scales;
- the need for sustainable funding mechanisms to support implementation of municipal stormwater infrastructure and nature-based recreation system recommendations;
- the need to establish new partnerships with business improvement associations, chambers of commerce and other community groups as a crucial step in moving forward with implementation initiatives;
- the need to evaluate recommendations within the context of provincial direction for intensification and sustainability; and
- the need to assess the economic implications of implementing the Watershed Plan integral recommendations.

A few other comments identified the need for minor points of clarification and updated references to current initiatives of implementing partners. These edits have been incorporated into the final document brought forward for approval.

Aboriginal Community
TRCA staff attempted to engage Aboriginal communities to be involved in preparing and reviewing the Watershed Plan but were unable to identify representatives who were able to participate. Staff believe that involvement of the Aboriginal community in the implementation of the Watershed Plan will be very important to its success, particularly considering the rich cultural heritage of the watershed. Staff is currently working in consultation with First Nations representatives on a protocol to identify proper First Nations contacts, means of communication, interests in TRCA projects and preferences for participating in future watershed planning and implementation activities.

Expert Peer Review
It had been our original intent to conduct an expert peer review on the final draft plan and supporting documents (in addition to the peer review that was conducted on the draft State of the Watershed Reports and Study Workplan). However, given the time required by staff to complete all background reports in conjunction with other concurrent watershed planning studies, TRCA staff has considered the relative benefits of additional peer review in relation to the further delays this would cause in finalizing and initiating implementation of the plan. We have considered the fact that we have already conducted peer review on core components of the watershed planning work, specifically:

- MODFLOW groundwater model was developed and reviewed by the multi-partner "YPDT groundwater group";
- The water budget model used in the Humber watershed planning study is consistent with a TRCA jurisdiction-wide water budget model developed as part of the CTC Source Water Protection program, which has been favourably peer reviewed by an independently-contracted expert;
- the TRCA's Regional Terrestrial Natural Heritage Strategy which formed the basis for the Humber watershed target terrestrial system has been peer reviewed; and
- the Duffins Creek watershed planning process, which the Humber study followed, was favourably peer reviewed and has been cited by the province and others as a state-of-the-art model.

We have involved external expertise in workshops as part of the plan development, and the plan itself and the supporting documents have been circulated for public and agency review and comment. Modelling of similar issues in neighbouring watersheds (i.e. Credit River, Rouge River) is showing similar watershed responses, and therefore we feel our work is further supported by these findings. Finally, we have acknowledged assumptions and areas of uncertainty in the modelling throughout the plan and supporting documents, and we are committed to facilitate further work in those areas. Based on these considerations, we believe our work is defensible and we would prefer to proceed to final approval to allow implementation of the many "no regrets", urgent recommendations which have many benefits. The plan is a living document, which can be updated in the future, as new science and approaches emerge.

Humber River Watershed Plan – Key Recommendations

The Watershed River Watershed Plan has concluded that a "business-as-usual" approach to future development will result in continued losses of environmental quality, biodiversity and cultural heritage, along with considerable costs to address the health, social and economic consequences of degraded environmental conditions and damaged infrastructure. A healthy, more resilient Humber watershed that supports a high quality of life for our communities is within reach only if opportunities to protect and restore healthy natural systems, build more sustainable communities, and enhance the regional open space system are acted upon. (see Attachment 1 – Watershed Plan Executive Summary). The plan sets out a number of strategic recommendations to protect and enhance valued resources, regenerate damaged systems and build more sustainable communities. These strategies fall into three broad categories:

- Expand the terrestrial natural heritage system
- Build sustainable communities (by improving water management and promoting sustainable practices overall)
- Recognize the distinctive heritage of the Humber through an enhanced regional open space system.

The recommended management strategies are as follows:

Environment

Water

1) Protect recharge and discharge
2) Increase natural cover
3) Improve sustainability of development design
4) Improve erosion and sediment control and site restoration
5) Implement stormwater retrofits
6) Maintain stormwater infrastructure
7) Prevent pollution
8) Manage flood risks
9) Protect stream form
10) Monitor, evaluate and adjust

Air Quality and Climate Change

1) Reduce vehicle use and other emissions
2) Enhance natural vegetation sinks
3) Undertake a vegetation impacts study

Aquatic System

1) Maintain or restore natural stream flow patterns and protect aquatic habitats
2) Optimize fish passage for native fish species
3) Support the draft Redside Dace Recovery Strategy
4) Improve recreational fishing opportunities

Terrestrial System

1) Secure a targeted system
2) Restore and enhance natural cover
3) Manage the matrix

Society

Cultural Heritage

1) Investigate and conserve cultural heritage prior to changes in land use
2) Establish a comprehensive communication plan with Aboriginal groups
3) Fill gaps in archaeological knowledge
4) Develop active and participatory programs to increase awareness
5) Develop a living cultural heritage program
6) Maintain the designation of the Humber River as a Canadian Heritage River

Nature Based Recreation

1) Recognize and enhance the regional system for nature-based recreation
2) Complete the inter-regional trail network
3) Establish public access to a northern gateway to the Humber watershed
4) Protect the unique experiences of the Humber watershed greenspace system
5) Develop plans to balance public access and resource protection
6) Interpret natural and cultural heritage
7) Form community partnerships for implementation

Economy

Urban Land Use

1) Protect significant landforms
2) Implement sustainable urban form
3) Implement sustainable infrastructure
4) Implement sustainable transportation

Agriculture

1) Provide GTA-wide services for local farm businesses
2) Support local food and increase public awareness about sustainable agriculture
3) Implement policies to support agriculture

Resource Use

1) Increase water efficiency and conservation
2) Reduce energy use and increase non-fossil fuel alternatives
3) Reduce waste

Implementation Guide – Top Priority Implementation Projects

The Implementation Guide organizes the Watershed Plan recommendations according to relevant implementation tools (e.g. policy, regeneration, land securement, stewardship and education, operations and maintenance, enforcement and monitoring) and identifies top priority projects for initial implementation (see Attachment 2 - Implementation Guide Executive Summary).

Like the Watershed Plan, the Implementation Guide is intended to inform and guide. The proposed projects contained in the Guide are meant to serve as a basis for discussion among implementing partners and as a source for the further development of individual partners' own long term work plan and budget preparations. Upon approval of the Humber River Watershed Plan, TRCA will initiate discussion with key implementing partners to develop five year workplans and budgets for the top priority projects, and incorporate them in capital budgets.

Revised ORMCP Conformity Assessment
At Authority Meeting #7/07, held on September 28, 2007, Resolution #A209/07 was passed as follows:

> *THAT the conformity assessment for the Humber River Watershed Plan and the watershed planning documents referenced in the conformity assessment be deemed to fulfill the watershed planning requirements of the Oak Ridges Moraine Conservation Plan (ORMCP; 2002);*
>
> *THAT the conformity assessment for the Humber River Watershed Plan and the watershed planning documents referenced in the conformity assessment be approved for use by the appropriate implementation authority on an interim basis in the review of major development proposals on the Oak Ridges Moraine until such time as municipal consultation is completed and a final watershed plan is brought back to the Authority for approval;*
>
> *AND FURTHER THAT the regional and local watershed municipalities and the Conservation Authorities Moraine Coalition be so advised.*

Staff have revised the conformity assessment, based on the final watershed planning document references (see Attachment 3 – ORMCP Watershed Planning Requirements Conformity Assessment for Humber River Watershed). Staff recommends that the revised conformity assessment and the final watershed planning documents referenced therein be approved for use in the review of major development proposals on the Oak Ridges Moraine portion of the Humber River watershed.

DETAILS OF WORK TO BE DONE
TRCA staff will take the following steps to facilitate the transition from plan to action:

- Design the desk-top-published version of the Humber River Watershed Plan document and distribute it to watershed partners;
- Meet with Aboriginal Community leaders to discuss the Watershed Plan and ways they may wish to be involved in its implementation;
- Meet with municipal staff and other key implementing partners to incorporate top priority projects in future years workplans and budgets;
- Meet with municipal staff and other stakeholders to initiate the plan for hosting a 2009 multi-stakeholder forum to identify priorities, associated budgets and responsibilities for the implementation of the Watershed Plan; and
- Include projects that implement the Humber River Watershed Plan recommendations, in annual capital budgets

Many municipalities, other agencies and local groups, have already begun to use the Watershed Plan to inform their ongoing projects and new initiatives.

FINANCIAL DETAILS
Total funding in the amount of $1,500,000 over 5 years was provided for the Humber River Watershed Plan by the Regional Municipality of York, Regional Municipality of

Peel and City of Toronto as part of the municipal capital budgets for TRCA. Additional grants totaling $50,000 were provided by Environment Canada's Great Lakes Sustainability Fund in support of the regeneration plan component of the Implementation Guide and social marketing research. In addition, the Remedial Action Plan Memorandum of Understanding funding indirectly supports the development of these plans.

Implementation funding for TRCA activities will be subject to capital allocations for 2009 and beyond.

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Date: June 12, 2008
Attachments: 3

Attachment 1

Humber River Watershed Plan
Pathways to a Healthy Humber

EXECUTIVE SUMMARY

The Humber River watershed is an extraordinary resource. It spans 903 square kilometers, from the headwaters on the Niagara Escarpment and Oak Ridges Moraine down through fertile clay plains to the marshes and river mouth on Lake Ontario. The watershed provides many benefits to the people who live in it. It is a source of drinking water drawn from wells or from Lake Ontario. Unpaved land absorbs water from rain and snowfall to replenish groundwater and streams and reduce the negative impacts of flooding and erosion. Healthy aquatic and terrestrial habitats support diverse communities of plants and animals. Agricultural lands provide local sources of food and green spaces provide recreation opportunities. A rich human heritage affords links to the past that enrich and inform our lives today. The natural beauty of the forests, meadows, farmlands, wetlands, rivers and creeks provides urban dwellers with solace, renewal and contact with nature.

However, this magnificent resource is under stress from human activities. The Humber Watershed Alliance, formed in 1994 to coordinate and promote activities to improve watershed health, gave the watershed an overall C grade in *Listen to Your River: A Report Card on the Health of the Humber River Watershed, 2007*. This grade was based on an average of the results for 26 indicators of watershed health that illustrate a wide range of conditions: from a very good rating for the protection of significant landforms to a failing grade for stormwater management. Conditions also vary considerably in different parts of the watershed, with generally higher grades in the upper, more rural parts of the watershed, and lower grades in the highly urbanized lower portions. This review of watershed health emphasized the need to continue working to protect what is valuable and restore what is degraded.

Issues identified in the report card include many harmful effects of urbanization on water balance, water quality, natural cover, aquatic and terrestrial communities, cultural heritage and air quality. These effects include increased surface runoff, more water pollution, greater annual flow volumes in rivers and streams, increased erosion and sedimentation, channel instability, smog, and losses of cultural heritage and biodiversity. All upland forest connections have been severed in the cities of Toronto, Brampton and the southern portions of both Vaughan and Caledon and more natural vegetation is scheduled for removal, according to current urban development plans. Only 25% of the urban area in the watershed has some level of stormwater management. The quality of fish habitat is deteriorating in many of the watershed's rivers and streams.

Successes include the 1999 designation of the Humber as a Canadian Heritage River, recognizing its importance in the history of First Nations peoples, the early Euro-Canadian explorers and settlers of Upper Canada as well as its contribution to the development of the country. Provincial initiatives including the *Niagara Escarpment Act,*

Oak Ridges Moraine Conservation Act, Greenbelt Act, Places to Grow Act, *2005 Ontario Provincial Policy Statement, Ontario Heritage Act* and the recently adopted *Ontario Regulation 166*/06 for conservation authorities all provide increased protection for landforms, environmental and cultural resources and agricultural lands. In addition, many protection, stewardship and regeneration projects have been implemented. Over 400,000 trees and shrubs were planted and 8.8 ha of new wetlands were created in the watershed between 2001 and 2006. The removal of in-stream barriers is allowing rainbow trout, brown trout and Atlantic salmon to return to spawning grounds in the Humber River for the first time in more than 150 years. The recent creation of the Oak Ridges Corridor Park in Richmond Hill is protecting 428 hectares of land from development and retaining the last remaining natural linkage between the western and eastern parts of the Oak Ridges Moraine.

The Humber watershed will experience further, major changes in land use over the next few decades. Approved official plans allow for an additional 8845 hectares of new urban lands beyond 2002 land uses, increasing the amount of the watershed that is urbanized from 27% to 36%. Once these plans are implemented, there will probably be further development in some watershed municipalities up to the boundaries of the *Greenbelt Plan* and *Oak Ridges Moraine Conservation Plan*. A large amount of commercial development is projected to occur along the east branches of the West Humber (Brampton and Caledon) and in the Rainbow Creek and Purpleville Creek subwatersheds (Vaughan). The proposed expansion of the 400 series of Provincial highways includes an anticipated extension to Highway 427 through the central part of the watershed. Trends in municipal servicing may result in a shift from groundwater supplies to lake-based water supplies, for example in Kleinburg and King City.

The population size and diversity of the Humber watershed continues to expand. In 2001 (based on census data) there were approximately 670,000 people living in the watershed, an increase of 37% from 1995. Much of this population growth, and associated urban development, has occurred within the City of Vaughan, Town of Richmond Hill and City of Brampton. The growing population and cultural diversity of the watershed may create demands for different types of nature-based recreation and cultural heritage interpretation activities as well as new approaches to community involvement in stewardship and outreach education programs.

What is the role of the watershed plan? The watershed plan is intended to inform and guide municipalities, provincial and federal governments, TRCA, non-governmental organizations and private landowners as they update their policies and practices for environmental protection and stewardship.

This updated watershed plan is part of an adaptive management approach to address these challenges. Since the publication of *Legacy: A Strategy for a Healthy Humber* in 1997, much has been learned about the Humber watershed from monitoring, research and the experiences of watershed partners. This plan updates the watershed management strategies in *Legacy* in light of new information, a stronger scientific foundation and better understanding of the effects of human actions on the ecosystem. There is also a need to respond to a number of recent policy and planning initiatives, including the *Oak Ridges Moraine Conservation Plan*, *Growth Plan for the Greater Golden Horseshoe*, *Clean Water Act*, City of Toronto's *Wet Weather Flow Management Master Plan*, stormwater retrofit studies of other municipalities, and TRCA's vision for The Living City.

The guiding framework for this watershed plan comprises a set of principles and 30 objectives with specific targets for watershed conditions. They address:

- **Environment:** stream form, groundwater, surface water, air, aquatic system, terrestrial system
- **Society:** cultural heritage, nature-based recreation
- **Economy:** land use, resource use

Nine potential future scenarios were developed and examined in relation to existing conditions to provide an understanding of how the watershed might react to changes in land use and environmental management in the future. This process revealed that if future development proceeds with current approaches to community design and stormwater management, it will not be possible to maintain current conditions, let alone improve them. Instead, there will be additional deterioration of environmental conditions, biodiversity and damage to infrastructure and property. Further, the analysis showed that even if the most innovative sustainable community measures are applied, this deterioration cannot be completely prevented throughout the watershed. The anticipated effects of climate change may exacerbate these concerns.

The pathway to a healthier, more resilient watershed that emerged from this analysis is based on a comprehensive and inter-dependent set of strategies that will protect and enhance valued resources, regenerate damaged systems, and build more sustainable communities. This will help to increase the resilience of natural systems to human activities and climate change. It will also create healthier places for people and wildlife and stronger support for economic activities.

The recommended management strategies fall into three broad categories:

1) **Protect and expand the terrestrial natural heritage system:** Figure 5.2 illustrates an expanded natural heritage system that provides multiple benefits, including biodiversity and habitats, water balance maintenance and restoration, opportunities for nature-based recreation, carbon sequestration, improved quality of life, and greater resilience to urban growth and climate change. This system can be accomplished by protecting existing valued assets, securing additional lands, regenerating degraded areas, and improving stewardship of public and private lands. The first priority is the lands in the potential greenfield development areas outside the Niagara Escarpment, Oak Ridges Moraine and Greenbelt. The second priority is the protected countryside areas of the

Greenbelt and *Oak Ridges Moraine Conservation Plans* and the rural area of the *Niagara Escarpment Plan*; and the third priority is in natural core and linkage areas of the *Oak Ridges Moraine Conservation Plan* and natural areas of the *Niagara Escarpment Plan*.

2) **Build sustainable communities:** More sustainable approaches to urban form, infrastructure, transportation and resource use are proposed in order to contribute to increased environmental integrity and quality of life. They should be applied to new communities, as well as to the intensification or redevelopment of existing ones. Some of the key features include reduced imperviousness, rainwater harvesting and other measures to maintain or restore predevelopment water balance, design features to facilitate sustainable choices (e.g. energy conservation, reduced vehicle use, support for local agricultural products) and protection and adaptive re-use of cultural heritage features. Erosion and sediment control practices must be improved to protect watercourses, especially in areas of intense urban growth. Development should be designed to proceed at a pace and extent that allows sufficient time to adopt, test and evaluate the effectiveness of new technologies and to make adjustments if the results do not meet the objectives and targets for the watershed.

3) **Recognize the distinctive heritage of the Humber through an enhanced regional open space system:** The Humber watershed has the basis for a significant, linked regional open space system including inter-regional trails, conservation areas, major municipal parks, and cultural heritage features and landscapes. Greater collaboration is needed between public and private sector partners to improve links between nature-based recreation and cultural heritage destinations and experiences and to facilitate better planning and management of the system. This system should be further developed to reach its potential to provide experiences for a growing population and support healthy communities, interpretation of natural and cultural heritage, links with local neighborhoods and connections to surrounding watersheds and regions. The status of the Humber as a Canadian Heritage River is a remarkable designation that should be promoted. Completion of a contemporary trail along the historic Carrying Place portage route that follows a spectacular river valley system would help to highlight and connect people with the natural and cultural heritage assets of the watershed.

To accomplish the management strategies, a **collaborative, integrated approach** is required. This begins with increased awareness to ensure that watershed residents, businesses, developers and agencies understand the importance of the watershed, its water cycle, natural systems and cultural heritage. The coordinated efforts of government agencies and community leaders must be applied to plans and policies, permits and regulations, enforcement, infrastructure operations and maintenance, stewardship and regeneration programs, and education and awareness initiatives.

Many challenges lie ahead on the pathway, but **a healthy, sustainable Humber watershed** is within reach. This plan shows that a “business-as-usual” approach to future development will result in continued losses of environmental quality, biodiversity

and cultural heritage, along with considerable costs to address the health, social and economic consequences of degraded environmental conditions and damaged infrastructure and property. Instead, there are opportunities to create a better future, with healthy natural systems and a rich natural and cultural heritage, supporting a high quality of life for our communities. With the guidance offered in this plan, a concerted effort by all watershed partners can bring these opportunities to fruition.

Attachment 2

Humber River Watershed Plan Implementation Guide

EXECUTIVE SUMMARY

Introduction

The *Humber River Watershed Plan – Pathways to a Healthy Humber (2008),* was prepared by the Toronto and Region Conservation Authority (TRCA), in partnership with municipal, provincial and federal government representatives and other stakeholders including the Humber Watershed Alliance. The Watershed Plan provides guidance to local, regional and provincial governments and TRCA as they update their policies and programs for environmental protection, conservation, and restoration within the contexts of land and water use, and the planning of future development. It also provides direction to local non-governmental organizations and private landowners with regard to best management practices and opportunities for environmental stewardship. The Watershed Plan is based on a strong understanding of current conditions developed through analysis of environmental monitoring information, combined with leading edge approaches to predicting potential future conditions that involved modeling and expert input. A series of management summit workshops were also held to develop recommendations that address key watershed management issues.

The Watershed Plan shows that a "business-as-usual" approach to future development will result in continued losses of environmental quality, biodiversity and cultural heritage, along with considerable costs to address the health, social and economic consequences of degraded environmental conditions and damaged infrastructure and property. A healthy, more resilient Humber watershed that supports a high quality of life for our communities is within reach only if opportunities to protect and restore healthy natural systems, build more sustainable communities, and enhance the regional open space system are acted upon.

Purpose of the Implementation Guide

The purpose of this guide is to facilitate implementation of the recommendations contained in the *Humber River Watershed Plan* by planners, consultants, managers, businesses, community groups, residents and other watershed stakeholders. The Guide organizes the Watershed Plan recommendations according to relevant implementation tools (Policy; Regeneration; Land Securement; Stewardship and Education; Operation and Maintenance; Enforcement; and Monitoring) and assembles additional information to inform initial action. The Guide outlines a 10 year work plan of implementation projects, within the context of existing programs and likely implementing partners. Like the Watershed Plan, the Implementation Guide is intended to guide on-going implementation and updating or development of programs and policies. The proposed projects contained in this Guide are meant to serve as a basis for discussion among implementing partners and as a source of ideas for further development of individual partners' own long term work plan and budget preparations.

Strategic Watershed Management Direction

The *Humber River Watershed Plan* concludes that the watershed is at a critical crossroads in that it continues to support many unique natural and cultural heritage values, and yet a number of present and anticipated stresses will challenge the ability to sustain present conditions. The Watershed Plan identifies three strategic management directions for the protection and enhancement of the watershed:

1. **Protect and expand terrestrial natural cover**
   Protect, restore and enhance natural cover in a target terrestrial natural heritage system. This action is especially important in areas upstream of existing and future urban growth, from a water management and erosion control imperative, and for parts of the target system vulnerable to loss or impact from urban growth, and from a habitat biodiversity standpoint. It will also contribute to serving the growing demand for nature-based recreation and provide greater resilience to climate change. Land use policy, regeneration and land securement projects are the primary implementation mechanisms to achieve this set of recommendations.

2. **Build more sustainable new communities and retrofit older ones to improve their sustainability** by improving water management and promoting more sustainable practices overall.

   a) *Improve Water Management*
   Manage for pre-development water balance (i.e., runoff volume control and maintenance of infiltration) by protecting natural heritage systems, naturalizing urban landscaping, using innovative lot level and conveyance stormwater management technologies, and rain harvesting. This set of actions is critical to water management and the associated health of the aquatic system.

   b) *Promote Sustainable Practices Overall*
   Facilitate the use of these innovative water management approaches by promoting improved urban form, green buildings and sustainable behaviour, and at the same time address a broad range of other objectives for the sustainable community. Of particular interest is the need to accelerate the shift to the adoption of more sustainable practices – through education/ awareness, testing, and demonstrating new technologies. A co-ordinated combination of new policies, “retrofit” type regeneration projects, improved operations and maintenance programs, stewardship/education, and monitoring initiatives will be necessary.

3. **Recognize the Humber’s distinctive heritage through an enhanced regional open space system**
   Further develop the regional open space system to support healthy communities and a growing population by securing additional lands for greenspace, expanding the trail network, and creating new opportunities for interpretation and celebration of natural and cultural heritage. Promote the distinctive experiences of the hills of the headwaters, kettle lakes and Humber valley wilderness as part of marketing campaigns for local businesses and attractions. Cultural heritage features and

landscapes are increasingly playing a role in recreation (e.g., rural heritage settings, adaptive re-use of heritage buildings) and opportunities to integrate them with the regional open space system should be considered. Active and participatory education programs were identified as a strategic means of engaging the public and raising awareness of these issues and several regeneration capital works initiatives have been identified to address this set of recommendations.

Top Priority Implementation Projects

This Implementation Guide outlines a 10 year work plan of implementation projects addressing all recommendations of the watershed plan, and is organized according to primary implementation mechanisms:

Policy;
Regeneration;
Land Securement;
Stewardship and Education;
Operations and Maintenance;
Enforcement; and
Monitoring.

The following list of top priority implementation projects and actions has been selected with consideration for their collective ability to address the three strategic management directions noted above, in an expeditious and mutually supportive way. They are not listed in any particular order. The reference numbers in brackets (i.e., 1-8) are the respective project numbers, as listed in the implementation work plan tables within the Guide, where additional information is provided.

Policy and Related Special Studies

1. Municipalities and TRCA should work together to investigate ways to incorporate the following **new policy directions** into their planning documents (see **Table 1.1** for details and Table 1.2 - project 1-1):

    a) Identify a **target terrestrial natural heritage system** (TNHS) based on the system recommended in the *Humber River Watershed Plan* and adopt policies to protect and restore natural cover.

    b) Manage for pre-development **water balance** (i.e., reduce excess runoff volume, maintain or restore natural levels of infiltration and evaporation) with particular emphasis on areas confirmed as **significant recharge areas.**

    c) Develop strategies and policies to promote **sustainable urban form,** including sustainable infrastructure, transportation and resource use.

    d) Conduct **Master Environmental Servicing Plans** (MESPs) in a subwatershed context to establish the environmental features, functions and linkages as part of the growth planning process rather than limiting them to political or land ownership boundaries.

e) Recognize, maintain and enhance a linked **regional open space system** that provides the basis for recreational experiences of the distinctive natural and cultural heritage of the watershed.

f) Conduct **comprehensive flood risk assessment plans** where intensification is proposed in a flood vulnerable area or Special Policy Area.

g) Support **stormwater retrofits** in existing developments and redevelopment projects (including road reconstruction).

h) Adopt policy to implement the Greater Golden Horseshoe Area Conservation Authorities' ***Erosion and Sediment Control Guideline for Urban Construction*** and update municipal Erosion and Sediment Control by-laws and Fill by-laws as necessary.

i) Adopt policy to recognize and implement the ***Humber River Fisheries Management Plan.***

j) Support **updated and expanded monitoring** programs, including ambient monitoring, requirements for pre-development baseline monitoring, and the promotion and testing of new technologies and their cumulative effects.

2. ORM Municipalities – recognize the Humber River Watershed Plan in their official plans, as required by the ***Oak Ridges Moraine Conservation Plan*** (1-7).

3. ORM municipalities and TRCA should prepare a **major development proposal review checklist** that specifies the information to be included in a development application and criteria to determine ORMCP conformity (1-8).

4. MPIR, MMAH, MOE, municipalities, TRCA, AMO, CO, BILD - Establish **development standards for sustainable community design** for application to new development proposals or urban expansions (1-3).

5. TRCA, municipalities and other approval agencies - Develop a strategy/procedure for **streamlining approvals for innovative designs** (1-4).

6. TRCA, BILD, municipality - Promote a **sustainable greenfield neighbourhood demonstration project** (1-5)**.**

7. TRCA – Undertake a continuous simulation and event-based hydrologic modelling study to determine the most conservative approach to sizing SWM ponds for flood control in future growth areas (1-11).

8. TRCA, municipalities – Undertake a scoped economic assessment of the implications of implementing the Watershed Plan integral recommendations, including valuation of ecosystem services, preparation of a methodology for applying the net gain approach, and development of recommendations for applying fairness and equity in implementation (1-18).

Regeneration

1. All partners – **Increase natural cover**: 1) in Oak Ridges Corridor Park, Nashville Resource Management Tract, Bolton Resource Management Tract and Claireville Conservation Area - implement existing restoration plans (2-1); 2) in Whitebelt - prepare restoration implementation plans for the natural heritage system identified in municipal plans and co-ordinate with developers (2-2); and 3) in Headwaters - prepare restoration implementation plans for targeted lands in priority areas and implement prior to urban development (2-3).

2. TRCA, municipalities – **Develop sustainable neighbourhood retrofit action plans** (2-8)

3. Toronto and Vaughan – **Undertake projects identified in stormwater retrofit plans** in Black Creek, Rainbow Creek, Lower Humber and West Humber subwatersheds. Projects in combined sewer areas should be undertaken first (2-9)

4. TRCA, NGOs - Continue restoration work in the **Humber Marshes and Humber Estuary** to increase wetland cover and improve aquatic habitat (2-11).

5. MNR, TRCA, Ontario Streams - **Further modify the eight (8) in-stream barriers** along the main channel between Bloor St. and Highway 401, to improve passage for jumping and non-jumping species, including repairing and improving the Raymore Park Fishway, upon completion of structural and fish passage assessments (2-12, 7-23).

6. Ministry of Culture and partners – **Establish a facility for archaeological artifact storage and document collections** that is accessible to researchers; secure funding for capital and operations (2-22).

7. TRCA, Ministry of Culture, Aboriginal groups - **Increase awareness of Carrying Place Trail heritage** by creating educational resources (e.g., book, video, webpage) and interpretive signs on contemporary trails (2-23).

Land Securement

1. TRCA – **Update priority list for land securement** within the Humber watershed based on the Humber River Watershed Plan's recommended priorities within the TNHS and for further development of the system of inter-regional trails and public greenspace (3-1, 3-4).

2. TRCA and municipalities - Work with MPIR to investigate mechanisms, as may be necessary beyond planning measures, to **secure the target TNHS lands in potential urban growth areas** (i.e., "whitebelt") that do not have any legislated protection from urban development (estimated to be 446 hectares) (3-2).

3. TRCA, municipalities, NGOs – **Secure lands** to establish the missing link in the Humber Trail between Steeles Ave. and Hwy. 7 along the main branch (3-5).

4. TRCA, municipalities, NGOs – Undertake a **land securement strategy** for the proposed East Humber Trail (3-6).

5. TRCA, Municipalities, NGOs – Undertake a study to: confirm the location of the historic Carrying Place trail; **identify a conceptual route for the proposed contemporary Carrying Place Trail** that connects the proposed East Humber Trail to a proposed northern gateway to the Humber greenspace system near Hackett Lake; and develop a strategy for the associated land securement and trail implementation (3.7).

Stewardship and Education

1. TRCA and municipalities – Deliver **technology transfer workshops, seminars and materials** for sustainable technologies, innovative stormwater management, erosion and sediment control, and sustainable urban form (4-1, 4-2, 4-8, 4-9).

2. TRCA, municipalities and others – Develop a co-ordinated program to **accelerate implementation of lot level retrofits** (rain gardens, permeable paving, rain barrels/cisterns and native plant landscaping) in priority areas by the business and residential and institutional sectors including resources for promoting rain gardens (2-8, 4-12, 4-14, 4-21).

3. TRCA, MNR, municipalities, community groups – Co-ordinate the development of educational materials on **invasive species removal** techniques and engage volunteer groups to help in monitoring and removal (4-18)

4. Municipalities, utilities, TRCA – Develop an outreach program based on the results from the Renewable Energy Road Map to promote the **uptake of renewable energy technologies** (4-35)**.**

5. Ministry of Education, Boards of Education, TRCA – Encourage all Boards of Education in the Humber watershed to participate in the **Ontario Ecoschools Program** and schools to achieve certification (4-54).

6. TRCA, NGOs, municipalities - Organize **annual community festivals or events** and provide opportunities to learn about and celebrate the natural and cultural heritage of the Humber River watershed (4-38).

7. TRCA and others – Develop a pilot project for Ontario **history and archaeology seminars for adults**, featuring Humber sites. Special attention to reaching out to new Canadians and descendents of the watershed as target audience (4-42).

8. TRCA and others - Develop a **communications plan** in partnership with Aboriginal groups to identify key groups and contacts, protocols for consultation and opportunities for cultural heritage interpretation, education and awareness programs, storing and viewing of artifacts, and special events (4-51).

9. Municipalities, federal and provincial agencies, institutions and businesses - Adopt a local food procurement policy (4-59).

Operations and Maintenance

1. Municipalities, TRCA – Prepare or update comprehensive stormwater management master plans for enhanced controls and low impact development in existing urban areas and new developments (5-1).

2. Municipalities, TRCA – Develop guidelines for designing and establishing municipal **SWM facility maintenance programs,** including monitoring, rehabilitation and financing mechanisms (5-2, 5-3, 5-4).

3. Municipalities – Conduct assessments of **sediment accumulation in SWM ponds** and develop a prioritized list of clean out projects (5-4).

4. Toronto, Vaughan – Undertake **urban storm sewer outfall studies** to identify high priority sources of bacteria and phosphorus. Focus on Lower Humber and West Humber subwatersheds (5-5).

5. Municipalities – Undertake retrofits of conveyance and end-of-pipe stormwater measures as part of **road reconstruction projects** to provide improved water quantity and quality control (5-6).

6. TRCA – Update the **Claireville Dam operations manual** (5-22).

7. TRCA, municipalities – Undertake an annual proactive program of EA projects to **implement high priority flood risk remediation projects** identified through the TRCA *Flood Protection and Remedial Capital Works Prioritization Project* (5-23).

8. TRCA, municipalities – Prepare **flood emergency response plan** for Special Policy Areas and flood vulnerable areas, including an inventory of hazards, prioritization, and emergency response protocol (5-24).

9. TRCA – **Track advances in the prediction of regional and local climate change** and reassess local flood risks and water management programs (5-25).

Enforcement

1. Various agencies, municipalities - Develop **inter-jurisdictional compliance protocols** for poaching (wildlife), erosion and sediment control, tree cutting, topsoil and land disturbance, dumping, trespassing, and encroachment). Identify gaps in regulatory capability and capacity. Identify options for addressing gaps. Develop resources and implementation plan (6-2).

Monitoring

1. TRCA and partners - Identify technologies that show promise and monitor their performance using **Sustainable Technologies Evaluation Program (STEP)** – i.e., Rainwater collection and re-use, permeable pavement, groundwater and soil contamination risk with infiltration technologies, etc. and long term performance and maintenance costs of any green technology (7-1, 7-2).

2. TRCA and partners - Launch a **cumulative effects (i.e., effectiveness) monitoring program** to assess the effectiveness of innovative development design in mitigating predicted impacts (7-6).

3. TRCA, municipalities- Review recommendations for additional monitoring in the Humber watershed as part of the 5 year review and **update of the Regional Watershed Monitoring Program (RWMP)** (7-7, 7-11, 7-12, 7-14, 7-17, 7-19).

4. York, Peel, Durham and Toronto – Conduct new gravity survey of Laurentian bedrock channel between Weston Rd. and Jane St. in Vaughan through YPDT Groundwater Management Project (7-13).

5. MNR, volunteers, TRCA - Develop a **volunteer based detection and response program for aquatic invasive species** (i.e., Round goby, rusty crayfish) (7-21).

6. MNR, TRCA – Evaluate the **effectiveness of in-stream barrier mitigation** and aquatic species partition barrier projects (7-22).

7. Municipalities – Develop and implement a program to **monitor trail use and participation rates** in other related recreational activities (7-25).

Tracking Progress

TRCA is proposing to convene an annual multi-stakeholder forum to report on progress at implementing the Watershed Plan and confirm priorities for the following year. Particular attention will be given to the status of top priority implementation projects recommended in this Implementation Guide. Other unanticipated opportunities will be considered as well, based on criteria such as partner contributions, expected outcomes and future benefits. Changes and trends in watershed conditions will be monitored through programs such as the Terrestrial Natural Heritage Program and Regional Watershed Monitoring Program. Results will be periodically reported by TRCA with the assistance of the Humber Watershed Alliance through the publication of progress reports, report cards and other appropriate media.

Attachment 3

ORMCP Watershed Planning Requirements – Conformity Assessment for the Humber River Watershed

Subsection	Requirement	Conformity Assessment	Document Reference
24.(1)	Every upper-tier municipality and single-tier municipality shall, on or before April 22, 2003, begin preparing a watershed plan, in accordance with subsection 24.(3), for every watershed whose streams originate within the municipality's area of jurisdiction.	Watershed planning and on-going watershed management have been activities the Toronto and Region Conservation Authority (TRCA) has carried out in partnership with its municipalities for a number of years. Therefore a watershed plan was deemed to have been initiated prior to April 22, 2003, acknowledging that some study components required updating to varying degrees. A watershed planning study was initiated by the TRCA, in partnership with the Region of York, Region of Peel, and City of Toronto and area municipalities for the Humber River watershed on June 25, 2004. A final draft of the *Humber River Watershed Plan* was completed on March 25, 2008. Approval of the final *Humber River Watershed Plan* by the Authority was granted at the June 27, 2008 meeting by resolution #A137/08.	A workplan to fulfill the watershed planning requirements of the ORMCP and direction to initiate the Humber River Watershed Planning Study according to the initial work program was approved by the Authority on Sept. 26, 2003 (Authority Res. #A196/03). A detailed workplan for the Humber River Watershed Planning Study was approved by the Authority on June 25, 2004 (Authority Res. #A191/04) Approval of the final *Humber River Watershed Plan* by the Authority was granted at the June 27, 2008 meeting by resolution #A137/08.
24.(3)	A watershed plan shall include, as a minimum, (a) a water budget and conservation plan as set out in section 25;	See conformity assessments for sections 25.(1) and 25.(2).	See document references for sections 25.(1) and 25.(2).
24.(3) cont'd	(b) land and water use and management strategies;	The *Humber River Watershed Plan* describes recommended management strategies regarding existing and future land and water use that will help to protect the ecological and hydrological features and functions of the watershed, including the portions in the Oak Ridges Moraine Area. Key strategies include the need to protect and expand natural cover and build sustainable communities, particularly with an aim to maintain or restore pre-development water balance.	See section 5 (Strategies) of the *Humber River Watershed Plan*.

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24.(3) cont'd	(c) a framework for implementation, which may include more detailed implementation plans for smaller geographic areas, such as subwatershed plans, or for specific subject matter, such as environmental management plans;	Implementation direction and initial considerations for priority actions and areas accompany the management strategies in the *Humber River Watershed Plan*. The *Implementation Guide* provides more detailed implementation direction for policy, regeneration projects, etc. including supportive maps and criteria.	See section 5 (Strategies) of the *Humber River Watershed Plan*. See *Humber River Watershed Plan Implementation Guide*
24.(3) cont'd	(d) an environmental monitoring plan;	The *Humber River Watershed Plan* includes recommendations regarding changes or enhancements to existing environmental monitoring programs and other area, site or issue-specific monitoring requirements.	See section 5.3.1 of the *Humber River Watershed Plan* and section 7 of the *Humber Watershed Plan Implementation Guide* for recommended enhancements to existing monitoring programs.
24.(3) cont'd	(e) provisions requiring the use of environmental management practices and programs, such as programs to prevent pollution, reduce the use of pesticides and manage the use of road salt; and,	The *Humber River Watershed Plan* includes recommendations regarding environmental practices and programs. The *Humber River Watershed Plan Implementation Guide* further identifies practices and policies applicable to the land use planning and development process. Many Humber watershed municipalities already require the use of environmental management practices (e.g., by-laws to control idling, dumping, filling, pesticide use, sewer use, and tree cutting, and salt management plans)	See section 5 (Strategies) of the *Humber River Watershed Plan*. See *Humber River Watershed Plan Implementation Guide* Also see endnotes for list of relevant municipal by-laws and salt management plans.[2]
24.(3) cont'd	(f) criteria for evaluating the protection of water quality and quantity, hydrological features and hydrological functions.	The *Humber River Watershed Plan* includes a framework of watershed objectives, indicators and targets to be used to track or evaluate long term watershed health. The accompanying *Implementation Guide* sets out recommended policies for the review of land use proposals regarding protection of groundwater and surface water quality and quantity, hydrological features and functions, as well as terrestrial features and functions and aquatic communities and habitat.	See Appendix C of the *Humber River Watershed Plan* for a summary of watershed objectives, indicators and targets used to track or evaluate watershed health. See *Humber River Watershed Plan Implementation Guide* for a compilation of all policies and maps showing where the policy recommendations apply.
24.(4)	Major development is prohibited unless, (a) the watershed plan for the relevant watershed, prepared in accordance with subsection 24.(3), has been completed;	A final draft of the *Humber River Watershed Plan* was completed on March 25, 2008. Approval of the final *Humber River Watershed Plan* by the Authority was granted at the June 27, 2008 meeting by resolution #A137/08.	Approval of the final *Humber River Watershed Plan* by the Authority was granted at the June 27, 2008 meeting by resolution #A137/08.
24.(4) cont'd	(b) the major development conforms with the watershed plan; and	See conformity assessment for section 24.(3)	See document references for section 24.(3)

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24.(4) cont'd	(c) a water budget and conservation plan, prepared in accordance with section 25 and demonstrating that the water supply required for the major development is sustainable, has been completed.	See conformity assessments for sections 25.(1) and 25.(2).	See document references for sections 25.(1) and 25.(2)
24.(8)	An application for major development to which this subsection applies shall not be approved unless, (a) the relevant municipality has complied with clause (c) of subsection 24.(4); or	See conformity assessment for section 24.(4)	See document references for section 24.(4)
24.(8) cont'd	(b) the applicant, (i) identifies any hydrologically sensitive features and related hydrological functions on the site and how they will be protected, (ii) demonstrates that an adequate water supply is available for the development without compromising the ecological integrity of the Plan Area, and (iii) provides, with respect to the site and such other land as the approval authority considers necessary, a water budget and water conservation plan that, (A) characterizes groundwater and surface water flow systems by means of modelling, (B) identifies the availability, quantity and quality of water sources, and (C) identifies water conservation measures.	For any applications received prior to completion of watershed plans, in accordance with the *Oak Ridges Moraine Conservation Plan*, conformity will have been reviewed and confirmed through applicant submitted studies.	

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25.(1)	Every upper-tier municipality and single-tier municipality shall, on or before April 22, 2003, begin preparing a water budget and conservation plan, in accordance with subsection 25.(2), for every watershed whose streams originate within the municipality's area of jurisdiction.	A water budget study was initiated in January 2003 by the TRCA, in partnership with the Region of York, Region of Peel, and City of Toronto and area municipalities for the Humber River watershed in advance of the overall Humber River Watershed Planning Study. The Region of York's Water for Tomorrow program outlines specific goals for both education and water conservation measures as outlined in the initial scope of work. The Water Efficiency Master Plan Update recommends new and/or updated programs for public education and water conservation measures. New goals for education and water conservation measures will be set once the program implementation plan is completed and approved by council. The Region of Peel's Water Conservation Plan was initiated in 2002 and completed in May 2004. The objectives of the plan are to reduce average annual day demand by 10 per cent, peak day demand by 10 per cent, and wastewater flows by 7 per cent, of projected 2015 levels. Key components of the Region's water efficiency efforts include public education through Water Smart Peel, rebate programs and other incentives. The programs are targeted to residents throughout the Region. The City of Toronto completed a water efficiency plan in 2002. The plan targets a reduction of peak day water demands by 275 ML/day or approximately 14% projected 2011 levels, and a reduction of wastewater flow by 86 ML/day, by 2011.	See TRCA 2003 Capital Budget Workplan and Authority approval to hire consultants to undertake a study terms of reference. Approval to initiate the Humber River Watershed Planning Study according to a general workplan, including a water budget study component, was granted at the Sept. 26, 2003 meeting of the TRCA (Authority Res. #A196/03) and further approval of a detailed workplan was granted on June 25, 2004 (Authority Res. #A191/04). *York Region Water Efficiency Master Plan Update, 2007.* *Regional Municipality of Peel Water Efficiency Plan – Final Report, Region of Peel, 2004.* *Water Efficiency Plan, City of Toronto Works and Emergency Services, 2002.* Approval of the final *Humber River Watershed Plan* by the Authority was granted at the June 27, 2008 meeting by resolution #A137/08.

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25.(2)	A water budget and conservation plan shall, as a minimum, (a) quantify the components of the water balance equation, including precipitation, evapotranspiration, groundwater inflow and outflow, surface water outflow, change in storage, water withdrawals and water returns;	The *Humber River Watershed Plan* includes a quantitative description of the major components of the water balance equation on an average annual basis over the watershed surface area. The water budget was developed based on available information regarding land use, vegetation, surficial soil characteristics, topography, stream flow at permanent stream gauges, permitted water withdrawals and spatial variations in long term average precipitation, temperature and evaporation across the watershed. It was developed using Precipitation Run-off Modelling System (PRMS) software. The PRMS model generated recharge estimates for input to the groundwater flow model (MODFLOW software), developed through the York- Peel-Durham-Toronto partnership (YPDT), which was used to estimate the groundwater component of the water budget.	Section 3.2.3 of the *Humber River Watershed Plan* describes the overall water budget for the watershed. The *Humber River Watershed Scenario Modelling and Analysis Report* provides a more detailed description of the existing water budget, including maps and tabular summaries, and the predicted effects of future land and water use and management scenarios on water budget components.
25.(2) cont'd	(b) characterize groundwater and surface water flow systems by means of modelling;	The groundwater flow system of the Humber River watershed has been characterized by development and calibration of a groundwater flow model that utilizes MODFLOW software, developed through the York-Peel-Durham-Toronto partnership (YPDT). The surface water flow system of the Humber River watershed has been characterized by development and calibration of a hydrologic model based on Hydrologic Simulation Program – Fortran (HSPF) software. This model was originally developed by the City of Toronto in support of work on the Toronto Wet Weather Flow Management Plan, and was refined for TRCA to support work on the *Humber River Watershed Plan.*	See section 3.2.3 of the *Humber River Watershed Plan* and section 4.0 of the *Humber River State of the Watershed Report – Geology and Groundwater Resources* for a characterization of the groundwater flow system. See section 3.2.4 of the *Humber River Watershed Plan* and section 5 of the *Humber River State of the Watershed Report – Surface Water Quantity* for a summary of the surface water flow system. The *Humber River Watershed Scenario Modelling and Analysis Report* provides more detailed descriptions of the existing surface and groundwater flow systems, including maps and tabular summaries, and the effects of future land and water use and management scenarios on these systems.

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25.(2) cont'd	(c) identify, (i) targets to meet the water needs of the affected ecosystems, (ii) the availability, quantity and quality of water sources, and (iii) goals for public education and for water conservation;	The *Humber River Watershed Plan* includes criteria in the form of maps and targets (both quantitative and qualitative) for the protection of groundwater and surface water quality and quantity, hydrological features and functions, as well as terrestrial features and functions and aquatic communities and habitat. Water efficiency plans or programs of the Region of York, Region of Peel and City of Toronto have set goals for water conservation and public education.	See 24.(3)(f) above for watershed targets. See section 4 of the *Humber River State of the Watershed Report – Geology and Groundwater Resources* and section 5 of the *Humber River State of the Watershed Report – Surface Water Quantity* for summaries of information on the availability and quality of water sources. Section 5.5.3 of the *Humber River Watershed Plan* addresses water conservation and supports continuation of municipal water efficiency and public awareness programs. See York Region *Water Efficiency Master Plan Update* (2007) See section 2.0 of Peel Region's *Water Efficiency Plan* (2004) See section 1.0 of City of Toronto's *Water Efficiency Plan* (2002)
25.(2) cont'd	(d) develop a water-use profile and forecast;	The Region of York, Region of Peel and City of Toronto have developed water-use profiles and forecasts as part of studies to update their water master plans. The forecasts consider the effect of planned water conservation measures on future demand. Drawing on this information,a watershed-based water use profile and forecast was developed as part of preparing the *Humber River Watershed Plan*.	See section 4.0 of York Region's *Long Term Water Project Master Plan Update, April 2004* for water use forecast. See Peel Region's *Water Efficiency Plan* (2004) for water use forecast. See City of Toronto's *Water Efficiency Plan* (2002) for water use forecast. See section 5.3 of the *Humber River State of the Watershed Report – Surface Water Quantity* for the watershed-based water use profile. Also see section 5.3 of the *Humber River State of the Watershed Report – Geology and Groundwater Resources* for a summary of groundwater takings in the Humber River watershed.

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25.(2) cont'd	(e) evaluate plans for water facilities such as pumping stations and reservoirs;	A watershed-scale evaluation of the predicted effects of forecasted water and land use on groundwater levels was completed in support of the *Humber River Watershed Plan*. Based on this evaluation, appropriate land and water use management strategies have been provided in the watershed plan. Further plans for any such facilities are evaluated by municipalities as part of environmental assessment studies and/or updates to water supply master plans and will be reviewed in the context of watershed-based information from the *Humber River Watershed Plan*, supporting technical reports and available databases.	See section 5 (Strategies) of the *Humber River Watershed Plan* for management strategies. The *Humber River Watershed Scenario Modelling and Analysis Report* provides a summary of predicted effects of forecasted water and land use on groundwater levels. York Region's *Long Term Water Project Master Plan Update*, April 2004
25.(2) cont'd	(f) identify and evaluate, (i) water conservation measures such as public education, improved management practices, the use of flow restricting devices and other hardware, water reuse and recycling, and practices and technologies associated with water reuse and recycling, (ii) water conservation incentives such as full cost pricing, and (iii) ways of promoting water conservation measures and water conservation incentives;	All upper-tier and single-tier municipalities in the Humber River watershed have developed water efficiency plans and programs that identify and evaluate water conservation measures, incentives and ways of promoting water conservation measures and incentives. The *Humber River Watershed Plan* supports the recommendations of the municipal water efficiency plans and programs and describes management strategies that would further contribute to achieving the objectives and targets of these plans/programs.	See section 5.5.3 of the *Humber River Watershed Plan*. See sections 5.0 and 6.0 of York Region's *Water Efficiency Master Plan Update* (2007) for the identification, evaluation and recommendation of water conservation measures and education. See sections 6.0 and 9.0 of Peel Region's *Water Efficiency Plan* (2004). See sections 4.0 and 6.0 of City of Toronto's *Water Efficiency Plan* (2002).
25.(2) cont'd	(g) analyse the costs and benefits of the matters described in clause (f);	All upper-tier and single-tier municipalities in the Humber River watershed have developed water efficiency plans and programs that analyse the costs and benefits of their recommended water conservation measures, incentives and promotion strategies.	See Section 5.2.3 of York Region's *Water Efficiency Master Plan Update(2007)* for the cost analysis of water conservation measures See section 8.0 of Peel Region's *Water Efficiency Plan* (2004) See section 5.0 of City of Toronto's *Water Efficiency Plan* (2002)

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25.(2) cont'd	(h) require the use of specified water conservation measures and incentives;	York Region's Water for Tomorrow program used specific water conservation measures and incentives as part of the original capital plan. The Water Efficiency Master Plan Update also recommends the use of specific water conservation measures and incentives. The Region of Peel and City of Toronto water efficiency plans also use specific water conservation measures and incentives such as system leak detection, computer controlled irrigation, watering restrictions, toilet replacement, clothes washer replacement, and indoor and outdoor water audits.	See section 6.0 of York Region's *Water Efficiency Master Plan Update* (2007) for the recommended program strategy. *See section 6.0 of Peel Region's Water Efficiency Plan (2004.)* *See section 4.0 of City of Toronto's Water Efficiency Plan (2002).*
25.(2) cont'd	(i) contain an implementation plan for those specified measures and incentives that reconciles the demand for water with the water supply;	York Region developed an implementation plan for the program as part of the scope of work in 1998. The Water Efficiency Master Plan Update has recommended an updated program strategy. An implementation plan for the updated program is being developed. The Peel Region and City of Toronto water efficiency plans include implementation schedules.	See Section 6.0 of York Region's *Water Efficiency Master Plan Update* (2007)for the recommended program strategy See section 9.0 of Peel Region's Water Efficiency Plan (2004). See section 6.0 of City of Toronto's Water Efficiency Plan (2002).
25.(2) cont'd	(j) provide for monitoring of the water budget and water conservation plan for effectiveness.	York Region's *Water Use Efficiency Master Plan Update*, Peel Region's *Water Efficiency Plan* and City of Toronto's *Water Efficiency Plan* recommend monitoring and evaluation programs be implemented. The *Humber River Watershed Plan* includes recommendations regarding changes or enhancements to existing environmental monitoring programs and other area, site or issue-specific monitoring requirements that provide for, or improve capacity for monitoring of the water budget (e.g., additional climate stations, stream gauges, groundwater monitoring wells etc.).	See Section 9.0 of York Region's *Water Efficiency Master Plan Update(2007)* See section 9.0 of Peel Region's Water Efficiency Plan (2004). See section 6.0 of City of Toronto's Water Efficiency Plan (2002). See section 5.3.1 of the *Humber River Watershed Plan* and section 7 of the *Humber Watershed Plan Implementation Guide* for recommended enhancements to existing monitoring programs.

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27.(1)	Except with respect to land in Settlement Areas, all development and site alteration with respect to land in a subwatershed are prohibited if they would cause the total percentage of the area of the subwatershed that has impervious surfaces to exceed, (a) 10 per cent; or	The Humber River Watershed Planning Study assessed the current and projected future percent impervious cover for each Oak Ridges Moraine subwatershed (based on methods suggested in draft Technical Paper #13 which exclude Settlement Areas, utilizing subwatershed boundaries defined in draft Technical Paper #9). These estimates indicate that no Oak Ridges Moraine subwatersheds in the Humber River watershed exceed the 10% impervious cover criteria for current conditions (based on 2002 land use), nor will they exceed 10% upon build-out of municipal official plans approved as of January 2005.	See *Humber River Watershed Oak Ridges Moraine Subwatersheds Assessment Technical Brief*
27.(1) cont'd	(b) any lower percentage specified in the applicable watershed plan.	No lower percentage has been specified.	N/A

Endnotes:

2. - City of Brampton Fill By-law, By-law 143-95.
- City of Brampton Refuse By-law, By-law 381-2005.
- City of Brampton Sewage By-law, By-law 90-75.
- City of Brampton Salt Management Plan, 2005.
- City of Brampton Tree Preservation By-law, Bylaw 38-2006.
- City of Brampton Woodlot Conservation By-law, By-law 70-2001 as amended by By-law 402-2005.
- City of Toronto Municipal Code, Chapters 455 (Filling and Grading), 517 (Idling of Vehicles and Boats), 548 (Littering and Dumping of Refuse), 612 (Pesticides, Use of), 658 (Ravine Protection), 681 (Sewers), and 813 (Trees),
- City of Toronto Salt Management Plan, 2004.
- City of Vaughan Fill By-law, By-law 189-96 as amended by By-law 265-2006.
- City of Vaughan Idling of Vehicles By-law, By-law 170-2004.
- City of Vaughan Littering and Dumping By-law, By-law 3-2004.
- City of Vaughan Private Property Tree Protection By-law, By-law 185-2007 as amended by By-law 205-2007.
- City of Vaughan Sewer Use By-law, By-law 12-74.
- City of Vaughan Tree Protection By-law (Public Property), By-law 95-2005.
- Dufferin County Forest Conservation By-law, By-law 2006-15.
- Dufferin County Salt Management Plan, 2005.
- Region of Peel Salt Management Plan, 2007.
- Region of Peel Sewer Use By-law, By-law 90-90.
- Simcoe County Tree-cutting By-law, By-law 5289.
- Simcoe County Anti-dumping By-law, By-law 4805.
- Town of Caledon Dumping on Private or Municipal Property By-law, 87-100.
- Town of Caledon Fill By-law, By-law 2007-59.
- Town of Caledon Healthy Horticultural Landscapes By-law, By-law 2003-81 as amended by By-law 2005-82.
- Town of Caledon Salt Management Plan, 2005.
- Town of Caledon Woodlands Conservation By-law, By-law 2000-100.
- Town of Richmond Hill Salt Management Plan, 2005.
- Town of Richmond Hill Tree Preservation By-law (Private Property), By-law 41-07.
- Town of Richmond Hill Water Use Restrictions By-law, By-law 157-05.
- Township of King Water Restriction By-law, By-law 75-43.
- York Region Salt Management Plan, 2004.
- York Region Sewage By-law, By-law S-0064-2005-009.
- York Region Trees By-law, By-law TR-0004-2005-036.